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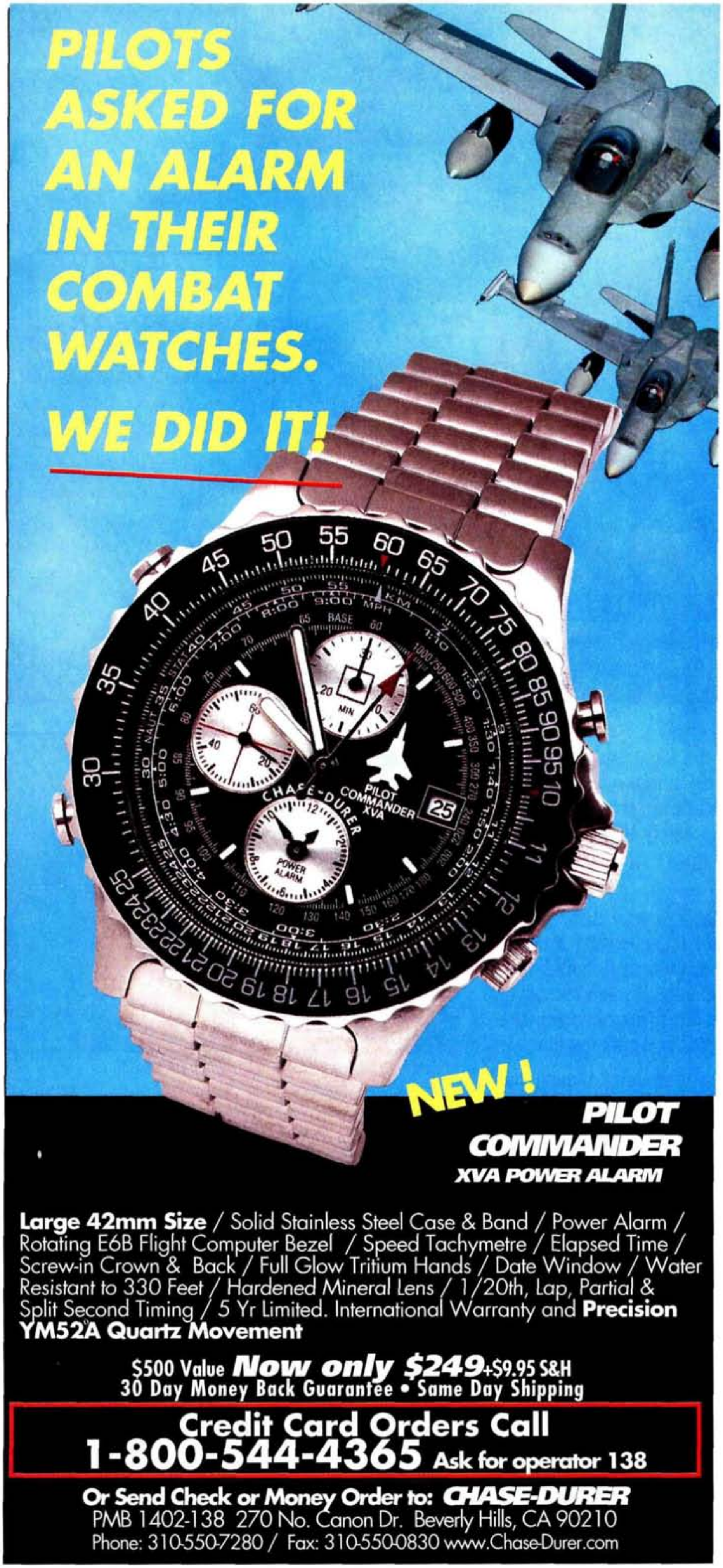
CONSTRUCTION

.20-SIZE ARADO 76



MODEL AIRPLANE NEWS
FOUNDED 1929

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SEPTEMBER 1999 • VOLUME 127, NUMBER 9

ON THE COVER: a Lockheed T-33 jet trainer built and flown by Wade Kloos soars over the San Bernardino National Forest (photo by Joe Chovan); insets: top right—the WattAge B2 is just one of the unique, lightweight electric R/C models that Dave Baron discusses on page 54 (photo by Walter Sidas); lower right—an Arado 76 designed by Stan Rutz is this month's featured construction article (photo by Stan Rutz).

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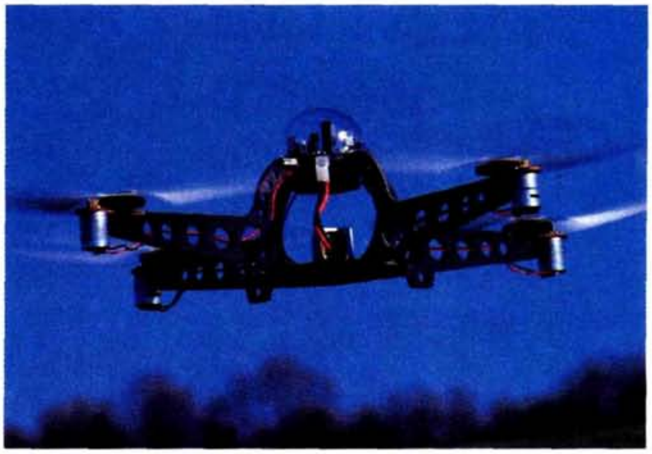
Backyard R/C grows



R/C planes that can be flown in your backyard continue to proliferate, as reflected in this issue's special features that examine four unique vehicles. David Baron takes a close look at the Area Fifty-One Roswell, Global Hobby's Wattage B2 and Hobby Lobby's IFO—all new on the scene and all with unique approaches to flight. In addition to those unusual aircraft, we have a special feature by one of our newest contributors, Bob Aberle, on the AIKA: an affordable, rechargeable electric that will fly for more than one hour on a charge.

BOB ABERLE TO WRITE FOR *MODEL AIRPLANE NEWS*

We are pleased that Bob Aberle will be contributing regularly to *Model Airplane News*. As many readers will recognize, Bob has been writing about the hobby for nearly 30 years and has contributed more than 30 original R/C designs. His distinguished background merits special mention. Bob started in model aviation in 1950, at the age of 12. At that time, he exclusively flew free-flight aircraft. By 1953, he had become involved in the beginnings of R/C and by the age of 15, had built his own supply of R/C equipment from surplus parts. His first R/C flight was with a Lou Andrews Guillow Trixter, "Beam." Because he was interested in electronics, he also obtained a general ham license at that time and has flown mostly on the 6-meter amateur band ever since.

Bob joined the AMA R/C Frequency Committee in 1976 and was chairman of that committee from 1980 to 1983, when the hobby's leaders were in the process of obtaining from the FCC what became our 80 "new," authorized R/C channels (50 exclusively for model aircraft use, and 30 more for surface vehicles such as cars and boats). After 23 years of volunteer service, Bob is still a regular member of that committee.

For his efforts as chairman during that critical time, Bob earned some of the most prestigious of all modeling awards, including the AMA Distinguished Service Award (1982), Howard McEntee Memorial Award (1982), AMA Fellow Award (with lifetime membership privileges—1982), Vintage R/C Society Hall of Fame (1982), Walt Billet Loving Cup (still at the AMA Museum—1983) and finally, induction in the AMA Hall of Fame in September 1998. In 1983, the AMA awarded Bob the three-digit license number of AMA-215.

Bob still flies actively in electric-power R/C competitions, including the annual AMA Electric National Championship (E-NATS) at Muncie. In 1996, he won his first national first-place trophy for Class-B Electric Old Timer (when he tells that story, with a smile, he admits that it took him 46 years to accomplish!). The AIKA duration electric featured in this issue is typical of Bob's groundbreaking projects.

OTHER HIGHLIGHTS

The ARF generation has led to a new line of products we survey this month: ready to fly (RTF) airplanes. Don't miss Don Edberg's article on troubleshooting your R/C gear; you'll learn some tips that will be of enduring value. Also in this issue, Dave Garwood offers high-impact coverage of a power slope-scale competition: the Inland Slope Rebels' meet at Cajon Summit in Southern California. And the Arado construction article by master modeler Stan Rutz will be of interest to the many builders among us. Finally, based on your feedback, we introduce this month a new feature called "Product Watch" that offers readers the opportunity to learn about various new R/C and related products through the eyes of reviewers who have actually used and tested them.

Would you like to see more of a particular type of article in *Model Airplane News*? Let us know by emailing us at man@airage.com, by faxing us at (203) 431-3000, or by writing to us at 100 East Ridge, Ridgefield, CT 06877-4606 USA. We want to provide you with the best coverage of the R/C hobby in print.

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column you'll find new things that will at times cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

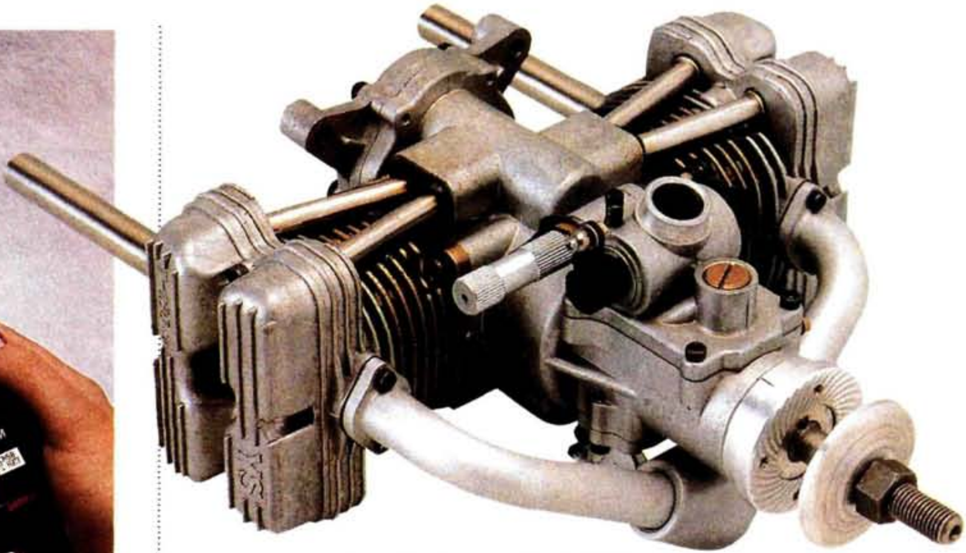
BY CHRIS CHIANELLI

SYSTEM X

Hitec makes a good value great

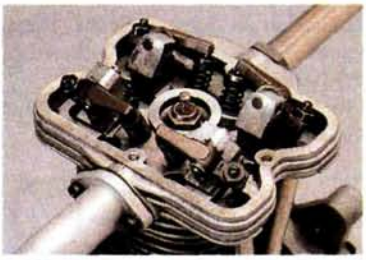
Hitec has taken its inexpensive and reliable Flash series radios and loaded them with features to create the new System X. Both of the new Flash 4 and Flash 5 System X radios include: five-model memory; three preset mixes (elevon, V-tail and aileron-rudder); digital trims; engine kill and trainer features; and both feature Hitec's new RCD Super-Slim receiver. The Flash 5 System X also offers three flight modes (acro, glider and glider/acro); flaperons; camber and reflex presets, and many other sailplane features. Once again, Hitec has pushed the value added concept to the limit. Thank you, Hitec … from all of us modelers.

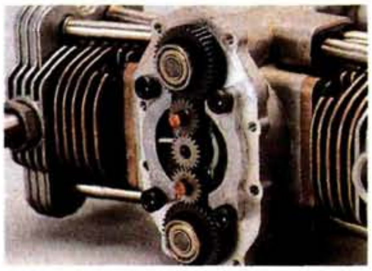
Hitec RCD Inc., 10729 Wheatlands Ave., Ste. C, Santee, CA 92071-2854; (619) 258-4940; fax (619) 449-1002; website: www.hitecrcd.com.



Twin-Cam Twin

I just had to show you guys YS's awesome new T-1.20 4V 4-stroke twin, even though at this point, I have no information on availability here in the States or even on production projections. Each cylinder head contains two exhaust valves and two intake valves that are driven by cams located at the "over and under" positions on the crankcase. The four rocker arms are operated in traditional pushrod fashion—again, with the pushrod tubes in both the top and bottom positions of the cylinder-liner case. It appears that YS has used its time-proven, positive-pressure fuel-delivery system on this engine; the pressure regulator is on the crankshaft housing, just in front of the carburetor. The crankshaft is a double-throw type that requires the connecting rods to be secured to the crank by using lower endcaps. I will definitely keep you updated on this one.





ARF Texan

If my recent experience with Great Plane's ARF ¼-scale Spacewalker is any indication, this new T-6 should also be a beautiful model. Constructed of all-wood materials and covered in MonoKote, this warbird can be ready to fly in 16 to 20 hours, according to Great Planes. All major sections are preassembled, and the plastic parts are hand-painted to match the covering. The Texan includes standard fixed gear, but the wheel wells and mounting rails are prefabricated for the installation of optional mechanical retracts. Specs: wingspan—59.75 inches; wing area—557.6 square inches; wing loading—23.2 to 26 ounces per square foot; weight—5.6 to 6.3 pounds; engine requirement—.40 to .46 2-stroke, or .48 to .80 4-stroke.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008; website: www.greatplanes.com.

THE LIGHTWEIGHTS ARE COMING

This is Taurus Engines' new 53-ounce TS-50: a 50cc (3.2ci) gas-ignition engine. Introduced at the recent Toledo Expo '99, the TS-50 kicked off Taurus's extensive line (2.6ci to 14.6ci) of single- and twin-cylinder ignition engines that incorporate new weight-saving techniques developed by the company to produce the lightest ignition engines possible. Also available from Taurus are engine mounts, single-bolt prop hubs, auto-advance ignition systems and other accessories. Taurus also offers a full complement of repair and modification services for Sachs, Husqvarna, Stihl, A&M and Walker engines. All new engines produced by Taurus are guaranteed and carry 2-year, limited warranties.

Taurus Engines, P.O. Box 1076, Southgate, MI 48195; (734) 283-4813; fax (734) 283-4813.

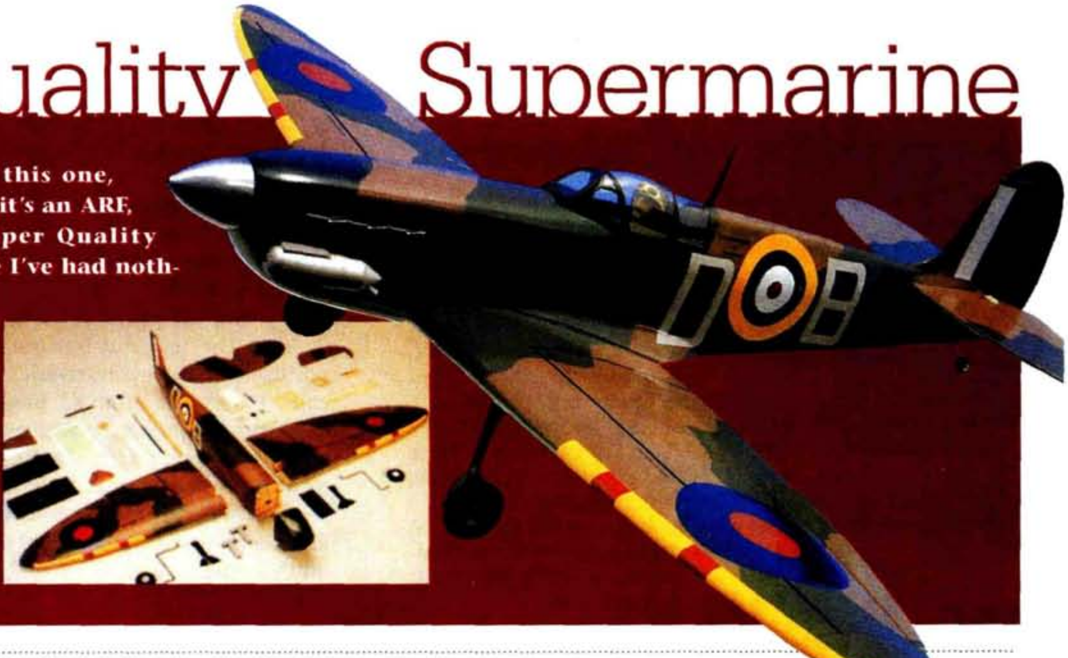
IC-2000

SHOCK-RESISTANT CA

IC-2000 is the latest addition to Bob Smith Industries' line of hobby adhesives. This black glue is a rubberized cyanoacrylate that forms a shock-resistant bond with non-porous surfaces. This CA has added flexibility: it's well-suited to bonding metals, fiberglass, rubber, carbon fiber and other high-tech materials. IC-2000 has been proved to work excellently on bulkheads and formers, and it does a particularly fine job of bonding servo rails to the inside of fiberglass fuselages. Setup time is 20 to 40 seconds but, as with any CA, this may be hastened with an accelerator such as Bob's Insta-Set. When it cures, IC-2000 remains pliable enough to be carved with a hobby knife and will withstand temperatures ranging from -40 to 250 degrees F.

Bob Smith Industries Inc., 8060 Morro Rd., Atascadero, CA 93422; (800) 223-7699; (805) 466-1717; fax (805) 466-3683.

Super-Quality Supermarine



I can't tell you much about this one, other than that it's a Spitfire, it's an ARF, and it's one of Kyosho's Super Quality Series; this tells me a lot, since I've had nothing but fantastic experiences with this super-fine ARF line. I can't wait to see it up close. Oh, yes; it does have about a 56-inch wingspan, so it probably calls for an engine in the .40 to .46 2-stroke or .53 to .60 4-stroke range. Stay tuned for more on this one.

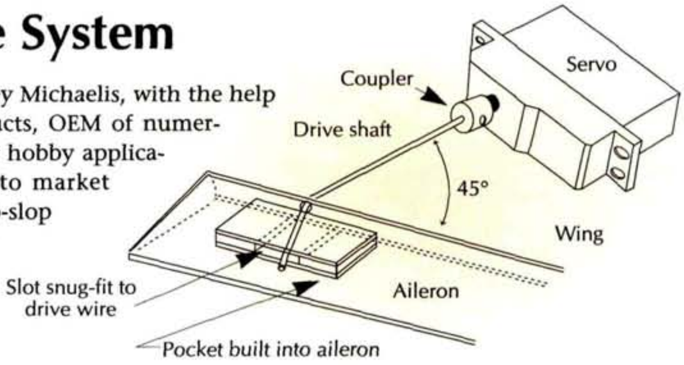
PRO CONNECTION

Fuel Cap

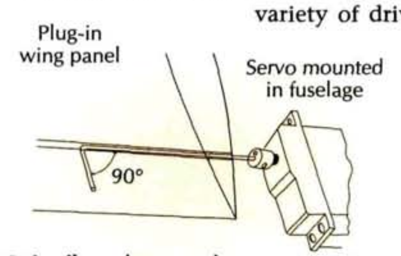
Slimline's new Pro Connection Fuel Cap is designed to thread onto any 1-gallon plastic fuel bottle. It's CNC-machined from 6061T6 aluminum, and that ensures a precision fit; the unique O-ring seal prevents leaking and keeps fuel factory-fresh. The Fuel Cap comes with four brass fittings for pick-up and venting and can be used with any fuel pump—hand or electric. It's available in red, black and aluminum.

Slimline Mfg., P.O. Box 3295, Scottsdale, AZ 85271; (602) 967-5053; fax (602) 967-5030.

All-Internal Rotary-Drive Linkage System



Veteran modeler Harley Michaelis, with the help of Kimbrough Products, OEM of numerous molded parts for hobby applications, has brought to market an all-internal, no drag, no-slop system for moving control surfaces. Called the Rotary Driver System, it is made possible by molded coupler parts that fasten directly to the output gear and secure a drive shaft that extends into a pocket in the aileron, flap, etc. As the servo rotates, the surface moves. Parts are provided to adapt the coupler to nearly any servo, and the coupler accepts a variety of drive-shaft diameters, as called for by different applications and airframe sizes. In the typical aileron application, there is a 45-degree bend in the shaft at the hinge line and the main shaft is angled at 45 degrees to the hinge. When the shaft rotates, its bent portion moves the aileron up or down by sliding inside a pocket inside the control surface. The illustration on the left shows a direct linkage from a servo to an aileron. There's more to this than we can describe here, so for further information, please check out one of these websites: www.bmi.net/propt/rds/, or www.valint.net/php/daledc/rds/.



Strip aileron/torque-wire arrangement
(no pocket required)

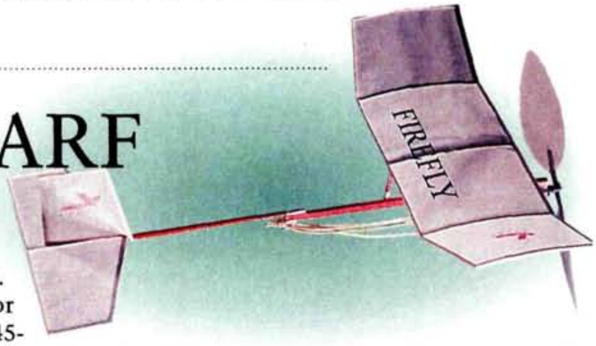
You can also contact inventor Harley Michaelis at hmlsf023@bmi.net to learn more about this innovative product. These new fittings are expected to be available soon through your local hobby shop.

NEWS FLASH!

A Bandit is loose in Brazil

Garland Hamilton and his Bandit stole the show at the FESBRAER event in Gaspar, Santa Catarina, Brazil. The awesome combination of this BVM jet, a Ram 750 turbine and Garland's super piloting skills wowed an audience of more than 2,000. Garland's Bandit isn't the only fast thing in Brazil, though; the entire hobby industry in that country is one of the fastest-growing in the world. Garland was a member of the Diniz Esteves team pictured here (from left): Wladislau Pontes (second Diniz Esteves-sponsored Bandit pilot), Ana Esteves, Garland Hamilton and Eduardo Esteves.

INDOOR ARF

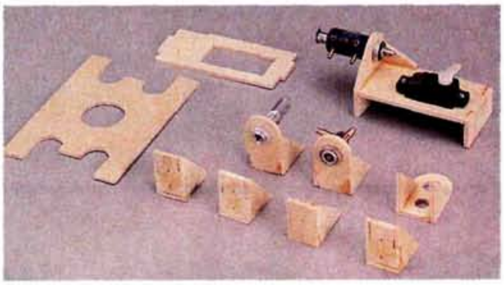


While I'm not usually in the habit of showing non-R/C models in the "Scoop," Hobby Lobby's Firefly is a special case. This 7.25-inch-wingspan indoor airplane is not only capable of a 45-second flight in a 10x10-foot room, but it also comes out of the box just as you see it here. That's right; ARF has entered the rubber-power arena.

Nothing at all to build; take it out of its box, attach the rubber "motor" and fly it. This balsa-and-tissue model weighs in at 2.7 grams and comes with excellent flying and flight-trimming instructions. Firefly can be loaded with more rubber bands to increase its flight duration to as long as 2 minutes.

The way things are going today, I know some of you lunatics will try to equip it with the ultra-micro R/C gear that's becoming available even as you read this. Oh, yes; the Firefly costs only $19.90!

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948; website: www.hobby-lobby.com.



Make short work of annoying jobs

Thanks to Great Planes' introduction of its new Handy Mounts, the tedious but all-important task of mounting servos, retract and other types of air valves, fueler nipples and cowls has just become much easier. In the Handy Mounts package are single and combination mounts that are die-cut from lite-ply. Whether you're building a kit or an ARF, Handy Mounts offer super convenience and increased building enjoyment.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008; website: www.greatplanes.com.

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.


MODEL AIRPLANE NEWS HOW TO

by Tony Newsom

Make a Concealed Muffler

A simple solution to an exhausting problem

There ought to be a law against installing a big, bulbous stock muffler on a really nice-looking airplane. I've always felt that a muffler detracts from a plane's good looks, so whenever possible, I enclose it in the cowl. The plane looks better and is cleaner aerodynamically. The downside is that you have to spend some extra cash on a new muffler that may not fit your application. Here's a way to make your own mufflers and customize them to fit your model exactly.

The supermarkets are full of potential expansion chambers for mufflers. I found a tin can that was an ideal size for .40- to .60-size models such as an Extra, Corsair, P-51 Mustang and CAP 21. The juice can I used is about 4 inches tall and 2 inches in diameter. You'll need to make your own header or buy one for the engine you intend to use, and you'll need a short silicone connector. These items will be the most expensive pieces of the project, but keep in mind that barring any damage to the header, you can use it over and over on future models. In addition, you will need two tin cans, silver solder, flux, copper tube and a heat source such as a propane or butane torch. Most modelers have everything else needed: an electric drill, round file and a tube cutter or hacksaw.

Attach the header to your engine, and mount the engine onto the plane so you can see where the expansion chamber fits best in the airframe. Use a can opener to remove the end of one of the cans. Solder this end over the pop-top end of the second

Left: you'll need two tin cans; the end of one will be soldered onto the pop-top end of the other, which will become the muffler. Right: make the inlet and exhaust holes where they best suit your application.

Two short lengths of copper tube will become the muffler exhaust and inlet.

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MORE ON MUFFLERS

In the July '99 issue of *Model Airplane News*, the story by Tony Newsom about how to make a concealed muffler was very interesting. I have three planes with O.S. Max .46 engines, and I have been using Pitts-style mufflers. They were quite expensive, and they are loud compared to the stock mufflers.

The article makes it look pretty easy to make this kind of muffler, at a substantial savings. The only problem I foresee is noise: is this muffler quieter or noisier than the stock muffler? I would appreciate any feedback about the dB because we are having noise-related problems at our field.

[email]
CHARLES MUNAFO

Hello there. When I wrote the article, I wanted to include more about the sound and the tuning of the muffler but thought it might make the article too long. Here is some of the information I left out.

First, let me tell you that the muffler has a very mellow tone. I've built a number of these mufflers, and in every case, the dB was lower than that of the stock muffler, and no power was lost. The larger expansion chamber created by the can allows the motor to breathe. I can tell you for certain that this muffler is much quieter than those Pitts-style mufflers. In my opinion, Pitts mufflers are more like exhaust diverters than mufflers.

Another thing: if you extend the outlet tube farther into the interior of the can, the tone gets even mellower! In other words, the can is about 2 inches in diameter, so if you were to insert the outlet 1 inch into the can, the sound turns into a mellow purr.

Want more? I've found that because of the configuration of the large chamber, residual oil is almost always trapped in the bottom of the can. When you fly the plane, ample oil comes out of the outlet and makes for a nice "contrail." You can always tell that your motor is running, even if you can't hear it.

More food for thought: I've built these mufflers with two outlet tubes instead of one. One of the outlet tubes was inserted farther into the can than the other, and as a result, my single-cylinder motor sounded like a twin.

Thanks for your interest.

Tony Newsom

LOOKING FOR A RYAN FIREBALL

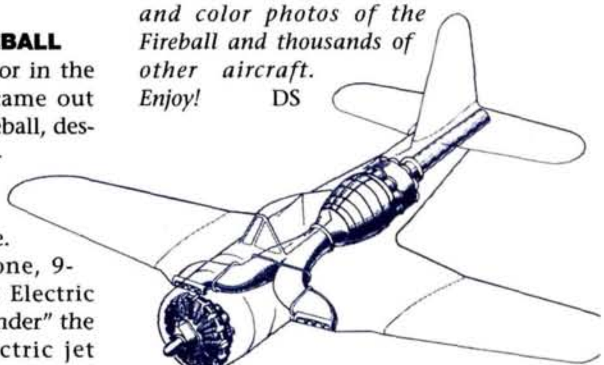
During WW II, I was an instructor in the Navy. At that time, the Navy came out with a fighter called the Ryan Fireball, designated the FR-1. This single-place fighter was the first military plane in the Armed Forces to be equipped with a jet engine. The plane had a Wright Cyclone, 9-cylinder engine with a Curtiss Electric prop up front; in the fuselage, "under" the cockpit, it had a General Electric jet engine that had 10 flame tubes, produced 1,650 pounds of thrust and used kerosene. The plane carried enough jet fuel for the engine to last approximately 15 minutes. I have photographs and news clippings of this plane.

I have never seen any mention of this plane since my Navy life, even though a squadron of FR-1s was supposed to be operational on an aircraft carrier in the Pacific.

Would you let me know why this plane has never gotten any publicity? After all, it was the very first military plane to be equipped with a jet engine. If you have any other information on this plane, please let me know.

AL COOPER
Kenmore, NY

Al, there are so many interesting and unique airplanes out there that it's hard to keep track of them all. Like the Ryan Fireball, each has its own story. While looking through the Model Airplane News *archives, I found this photo and illustration of the Fireball's Wright Cyclone engine and General Electric turbine jet engine. Additional documentation is available from Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058; fax (714) 979-7279; website: http://imt.net/~ims/scale.html. In his catalog, Bob offers 3-views and color photos of the Fireball and thousands of other aircraft. Enjoy!* DS



BALANCING ACT

I am new to helicopters, having recently bought a Shuttle Challenge, and I attended a small show put on by Hirobo [the heli's manufacturer] in May in Chino, CA.

I am now at the stage of putting the blades on, and the instructions say I should balance them. This step requires that you cut back the covering and then glue and screw on the two blades' root ends. It shows a picture of the two blades together and tells you to balance them by adding tape to the lighter blade. How do you join the two blades to balance them?—just use a nut and bolt through their mount hole? No bolt came with the kit for this! Or do I go back and take the rotor head off the main shaft and join the blades to it?

I enjoy Rick Bell's articles and always wish they were longer. I'd also love to see some articles about basic flying. Keep up the good work. [email]

ED NADEAU
Maine

Thanks for reading my column and for the positive feedback; I really appreciate it! You made a great choice for your first heli. I had a chance to fly the prototype last year and was impressed. To do the balancing as shown in the manual, you can use any bolt that will fit through the hole. Be sure to follow the instructions for attaching the root ends; this is very *important! Do not use CA glue to attach them; use a slow-setting epoxy, and also roughen the root ends' gluing surface to ensure a good bond. Balance the blades after the epoxy has cured.*

As for articles on flying, I'll write about hovering basics and tell how to work up to forward flight. Keep me posted on how you do, and good luck. Feel free to drop me a line anytime.

RICK BELL

MORE NITRO?

My friend and I have a simple question that I hope you'll easily be able to answer: we run 15-percent-nitro fuel in our aircraft, and they seem to run just fine for our climate, but like most fliers, we wonder what the effect on our models would be if we ran 20-percent-nitro (or higher) fuels. We use .40 to .60 O.S. engines in most of our models. Would it be worth the extra bucks to use a fuel with a higher nitro percentage?

Thank you in advance for any information that you may be able to give.

WAYNE KYKER
Kingman, AZ

Wayne, we went to our engine guru Dave Gierke for an answer to this one, and here's what he had to say. For general sport flying, going from 15- to 20-percent nitro won't give you much of an increase in performance. If you're looking for more rpm, reduce the prop load; that is, prop pitch and/or diameter.

For the most part, increasing the nitro content will also increase engine temperature, so if you do decide to try it, watch the cylinder and head temperatures. Good luck.

GY

FAREWELL, FRIEND *by Chris Chianelli*

Frank Garcher: 1928-1999

On May 22, Frank Garcher, president of Midwest Products, passed away.

Besides helping to build our wonderful hobby and serving as president of one of the most venerable hobby companies (Midwest was established in 1951), this influential personality was a friend to all. Of my friend, I can say only this: he was one of the happiest and kindest individuals I've ever known.

I met Frank at the first hobby show I ever attended, in Pasadena, CA, in 1983. I knew no one and was very nervous. Frank and Carl Goldberg made me feel both comfortable and included by graciously introducing me to many of the industry's more notable individuals.

Frank's philosophy was "Enjoy life to the fullest." Whenever I arrived at a show and saw Frank, I knew instantly that fun was very close at hand.

Many years ago, when I arrived at the convention center for the very first Chicago Hobby Show, I was startled out of my jet lag when Frank—all 6 feet, 5 inches of him—jumped out from behind a support column with a loud "GOTCHA!" At the last Chicago show, I was hitching rides on Frank's Little Rascal electric scooter.

It didn't matter where the piano bar was: Nuremberg, Germany; Florianopolis, Brazil, or good ol' Chicago; Frank would sing us a song—and we'd listen.

Frank always used to say, "Now I ask you, who has more fun than people?" One thing is certain: people had fun—and felt a little better about themselves—when Frank Garcher was around. Thank you, Frank. You—we will miss.

SEEKING OLD ISSUES OF *MODEL AIRPLANE NEWS*

Air Age Publishing is interested in acquiring additional back issues of *Model Airplane News* to further supplement our archives. We are particularly interested in obtaining copies of the first issue, published in July 1929, and we will consider purchasing partial collections. Interested parties, please contact us by mail at MAN Issue Archives, c/o Air Age Publishing, 100 East Ridge, Ridgefield, CT 06877-4606 USA; fax (203) 431-3000, or via email to man@airage.com.

PILOT PROJECTS

A look at what our readers are doing

SEEING DOUBLE DOWN UNDER

Dale Nicholls of Clayton, Victoria, Australia, and his father, Colin, built this pair of One Designs. The 6-pound models are covered in MonoKote and have Rich Uravitch cowls and canopies. The innovative modelers made carbon fiber-reinforced fiberglass wheel pants using their own molds. The "One" on the left has an O.S. .45 FSR for power; the other uses a gravity-defying O.S. .70 Surpass. Full cockpit detailing includes headsets on the pilots and simulated walnut instrument panels. Dale tells us that everyone at their flying field expected the models to be a real handful; in the air, however, the Ones are responsive yet controllable.

BASHED BIPLANE

Don Ogren of Rochester, NY, began with the Great Planes Aeromaster kit and fashioned it into the lines of a Great Lakes biplane. The Thunder Tiger .61-powered airplane is covered with 21st Century cream and maroon fabric and is detailed with a scale windshield and an open cockpit. Don tells us that his $7\frac{1}{2}$-pound creation gets attention at just about all the fun-flys—even the "scale-only" gatherings.

CATALINA COMPLETION

Don Harris of Bandon, OR, started out 12 years ago with a Glasco PBY kit. Slowly but surely, the twin O.S. .40 FP-powered amphibian has been completed. The model features retractable wingtip floats as well as computer-mixed independent throttles that act in conjunction with rudder-stick movement on Don's Futaba radio. He also added a steerable water rudder to turn the 92-inch-span model. Future plans include the installation of a fire retardant drop system, depending on the results of the flight test.

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

ITALIAN PLAN FAN

After almost 40 years of R/C modeling, Amilcare Angelucci of Milan, Italy, built his first ducted-fan jet. The Skyburner, from *Model Airplane News* plans, is powered by a Rossi R .53 mated to a Gleichauf pusher fan unit. This power combination enables it to take off from grass and fly like a sport airplane at around 65-percent throttle; according to Amilcare, "... full bore is another thing!" Amilcare tips his hat to the Skyburner's designer who, he says, simplified the approach to an otherwise complicated side of our sport.

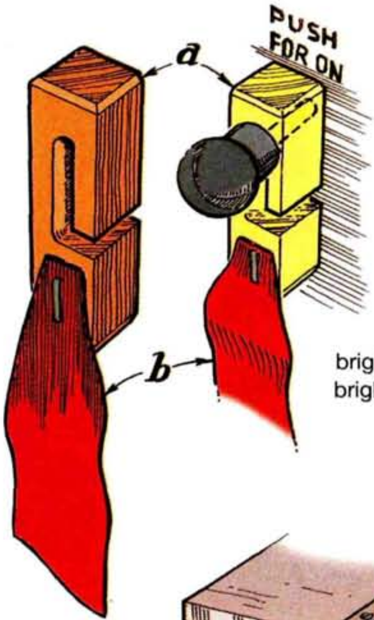
TRI, TRI AGAIN

Frank Jaerschky of Taradale, Napier, New Zealand, constructed this $\frac{1}{4.5}$-scale Fokker DR-1 triplane from a set of modified Ziroli plans. He used a more scale-like stick structure on the Q-35-powered plane as well as "saw-tooth" leading-edge sheeting, just like on the Red Baron's full-size plane. Frank had heard that the Fokker DR-1 commonly nosed over during landings, and he set out to combat the problem by moving the nose gear slightly forward. In more than 50 landings, he has never experienced a nose-over.

HINTS & KINKS

BY JIM NEWMAN

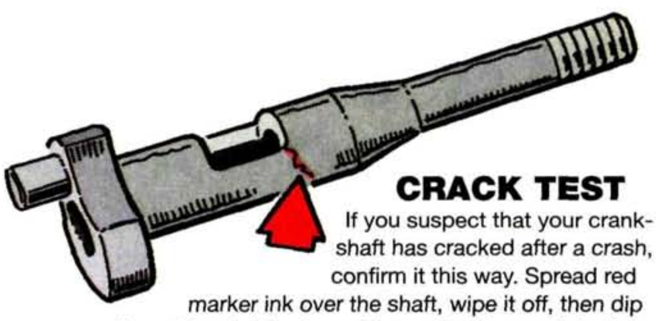
SEND IN YOUR IDEAS. *Model Airplane News* will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



LOCKED OUT

To prevent the receiver switch from being accidentally pushed on during transport, cut a block of 3/8-inch (9mm) square basswood (a), slot it as shown, then hook it over the switch knob shaft. Paint it bright yellow or orange and attach a bright streamer (b), too.

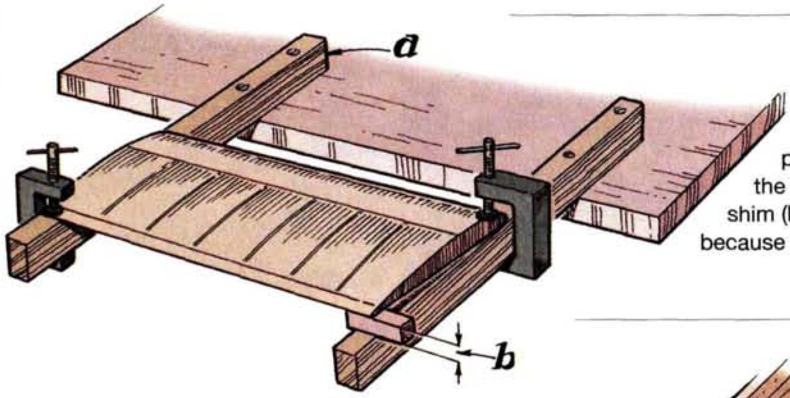
Dennis Bryant, Burgess Hill, W. Sussex, England



CRACK TEST

If you suspect that your crankshaft has cracked after a crash, confirm it this way. Spread red marker ink over the shaft, wipe it off, then dip the entire shaft in dope thinner. Dry the crankshaft, then dust chalk over the shaft. If there's a crack, the ink will seep through and make a red stain.

Eric Marsden, Horndean, Hants., England



WASHOUT JIG

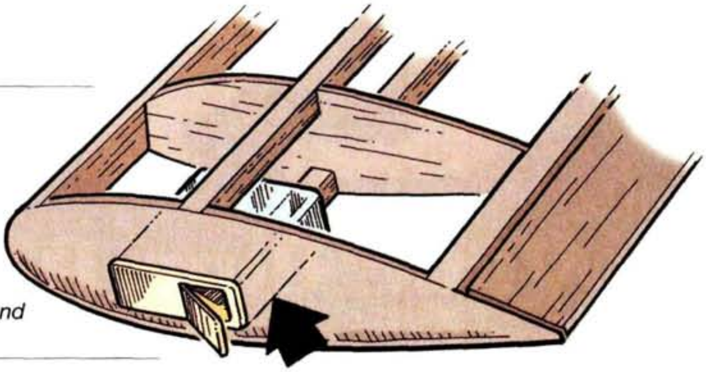
Assemble this simple jig to set the washout in your wings. Be sure the 1x2-inch (25x50mm) pine sticks (a) are straight before you clamp down the wing panels and heat the covering. The washout shim (b) is the required thickness plus 25 percent because the wing will spring back a little.

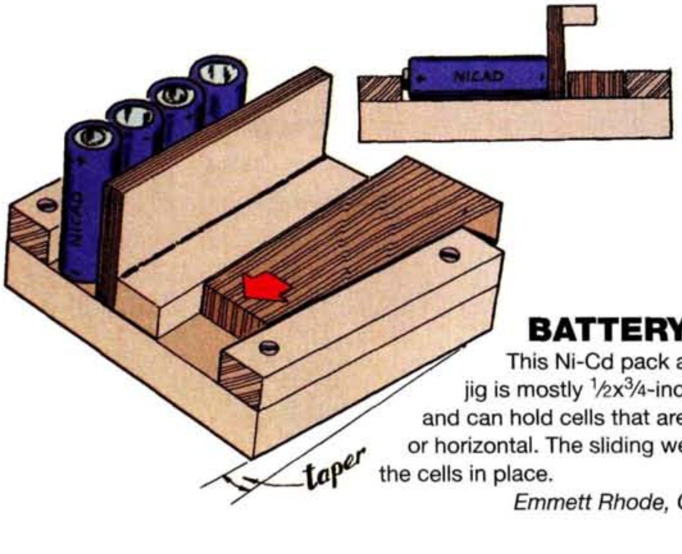
Paul Stahlhuth, El Dorado Hills, CA

WEIGHT BOX

Hollow out the left wingtip of your profile fun-fly ship, then glue in a breath-mint dispenser, using shims to set it between the spars. Add lead shot and a little epoxy (to stop the rattle) so that it will counterbalance the offset weight of the side-mounted engine.

N. Froude, Fairlie, New Zealand





BATTERY JIG

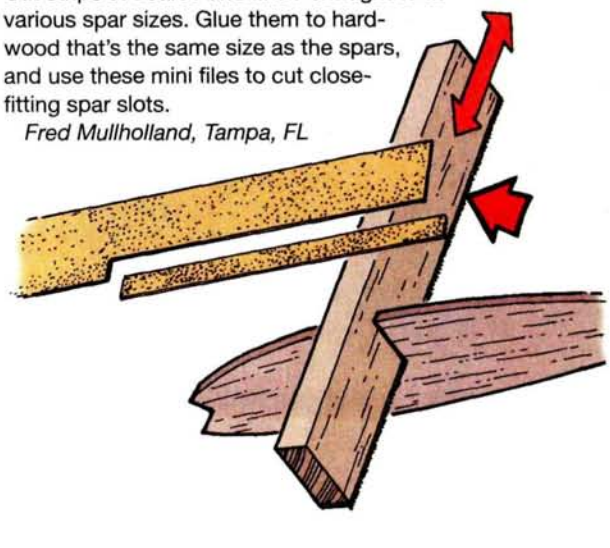
This Ni-Cd pack assembly jig is mostly 1/2x3/4-inch pine and can hold cells that are upright or horizontal. The sliding wedge locks the cells in place.

Emmett Rhode, Canby, MN

RIB SLOTTER

Cut strips of coarse and fine Permagrit to fit various spar sizes. Glue them to hardwood that's the same size as the spars, and use these mini files to cut close-fitting spar slots.

Fred Mullholland, Tampa, FL

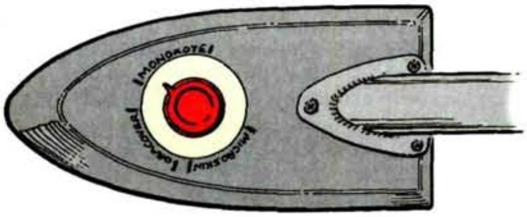


HINTS & KINKS

HEAT QUICK PICK

Use a permanent marker to write the heat range of the covering materials you use on the dial of your iron for quick reference.

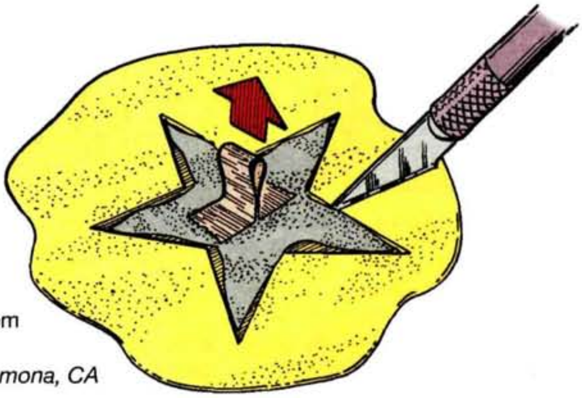
Vince Cahill Jr., Venice, FL

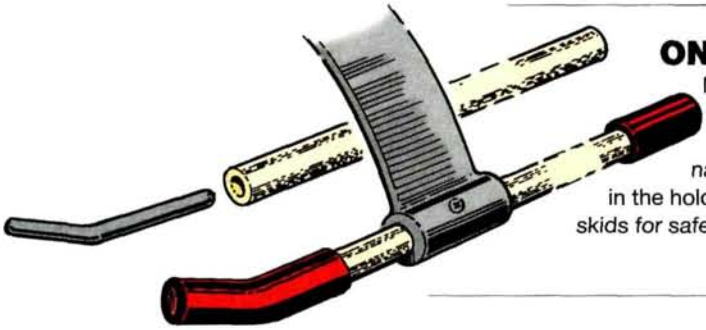


GET A GRIP

Make folded masking-tape handles to remove cutout areas of dried liquid masking fluid. The cutouts will lift out easily, and you won't have to dig at them with a knife blade.

Chin Tang, Pomona, CA





ON THE SKIDS

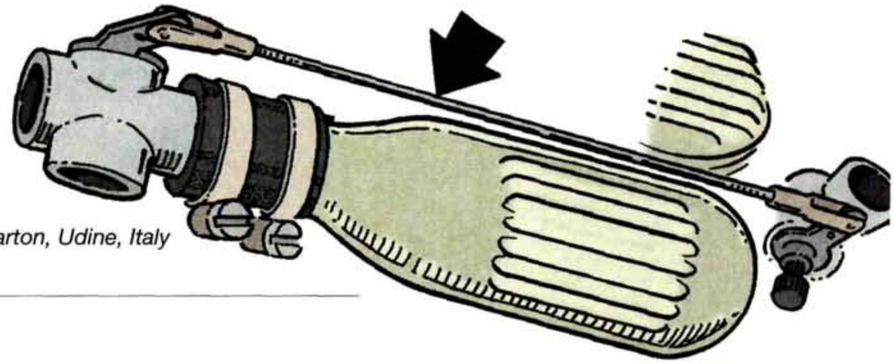
Make new skids for your Nexus 30 copter by cutting Dave Brown 5/16-inch fiberglass pushrods to match the old skids. Epoxy in a cut aluminum nail that's bent up 25 degrees, then insert the skids in the holders. Put heat-shrink tubing over the ends of the skids for safety.

Mike Gasiorek, Danielson, CT

THROTTLED PRESSURE

This reader could not get a reliable idle no matter what he did, so he attached an old carburetor to the end of the muffler and coupled it to the engine throttle with a pushrod to get controlled back pressure. This gave him a great idle and instant pickup!

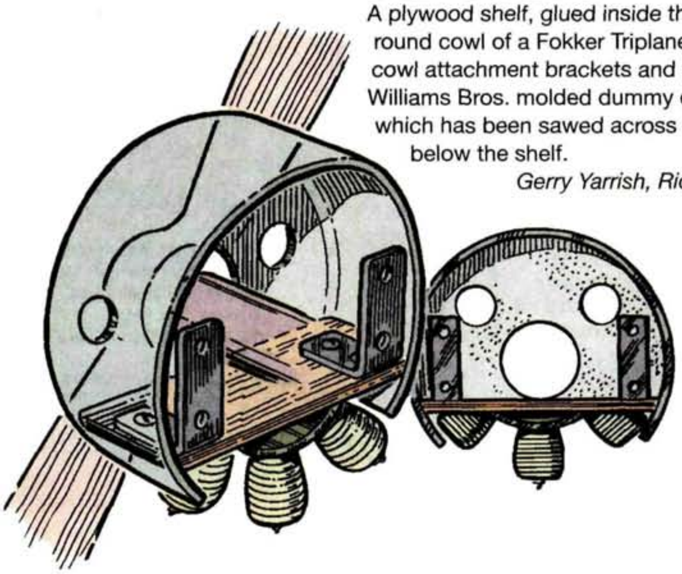
Isacco Vallerugo Scarton, Udine, Italy

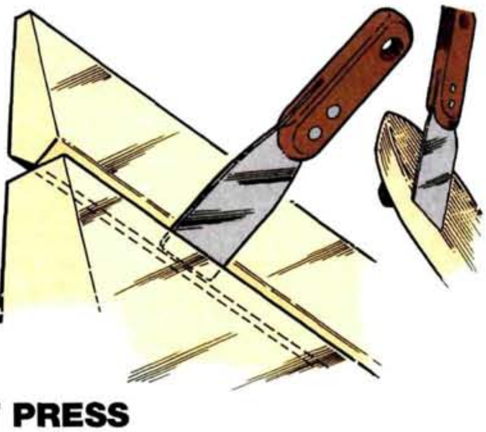


DR.1 DUMMY

A plywood shelf, glued inside the half-round cowl of a Fokker Triplane, holds the cowl attachment brackets and the Williams Bros. molded dummy engine, which has been sawed across and glued below the shelf.

Gerry Yarrish, Ridgefield, CT





HOT PRESS

When you cannot get your hot covering iron down into narrow slots to bond the film to the balsa, heat the blade of a putty knife on the sole of the iron, then use the knife to tuck and bond the film.

Robert Duncanson, Harbor Beach, MI

The Model Airplane News

GUIDE TO READY-TO

JUST BUY

READY-TO-FLY (RTF) model airplanes are here! The natural outgrowth of the almost-ready-to-fly (ARF) trend, these newest models reflect an increase in product quality even as they save the modeler building time. Believe it: with most of these planes, you could not buy the individual components and assemble them yourself with any cost savings. And we're all so busy these days that for some of us, RTF models offer our only chance to enjoy the sport of flying R/C aircraft. Time in the workshop is usually less than an hour; some take less than 20 minutes to get airborne.

Although only a few manufacturers have yet taken the plunge with this new species, it's likely more will follow. It's also notable that some sailplane vendors (such as Northeast Sailplanes* and Slegers Intl.*) have been custom-assembling powered sailplanes for some time. Now this trend has evolved to include manufacturers of traditional glow-powered R/C aircraft.

This guide to R/C RTF airplanes presents an overview of the selection now available. Criteria for inclusion were that they be proportionally controlled aircraft with powerplants and servos installed. Short of having a plane arrive at your house in the box and with its engine idling, this compilation of RTFs represents your quickest avenue to getting airborne.

—by the staff of
Model Airplane News

*Contact information for the companies mentioned in this guide is listed in our Index of Manufacturers on page 134.

TRAINERS

HOBBICO SUPERSTAR 40 SELECT

The Superstar 40 Select is one of the most full featured and easily repaired of the new generation of ready-built aircraft. All you need are a screwdriver and a pair of pliers to ready this airplane for flight. Hobbico has tried to think of everything to ensure a new pilot's success. The flat-bottom wing halves are joined with a unique metal-rod system that simplifies assembly and transportation. Power is supplied by an O.S. 40LA engine that uses a remote needle valve; this makes adjusting the air/fuel mixture much more convenient. The Hobbico* Superstar is made entirely of balsa and ply and covered with MonoKote. This creates a notably strong and attractive airplane that, most importantly, can be easily repaired.

THUNDER TIGER TRAINER 40 SC

This trainer is completely built and covered and features printed graphics. The "SC" stands for "super combo," which means that the transmitter is included and the receiver is installed. Like others in the Thunder Tiger line of ready-built aircraft, this trainer includes a large, flat-bottom wing and installed engine, prop, glow plug, fuel tank, switch harness, servos and wheels. The 40 SC features all-wood construction, except for the turtle deck and wingtips, which are vacuum-formed plastic. All you need to do is join the wing halves, glue on the stabilizer, install the landing gear and fuel it up; you're ready to fly using the Hitec Focus 4 radio.

THUNDER TIGER 60 SC

The 60 SC includes all the basic features of the 40 SC and, for only $40 more, includes an installed Thunder Tiger GP .61 engine. This trainer has a 6-foot-plus wingspan and exhibits the more docile flying characteristics and higher visibility that's typical of larger aircraft. Like its sibling, the 60 SC has sufficient dihedral to enhance flight stability.

FLY AIRCRAFT

A N D F L Y !

MAIN PLANES **BUSH BIRD JR.**

With its 10-foot wingspan, the Bush Bird Jr. is by far the largest airplane in our survey. Its size provides a visibility advantage for novice pilots and for towing sailplanes up to high altitude. This foam-and-ply top-wing aircraft is also capable of performing mild aerobatics. Although provided in standard configuration with a Magnum XL .46 and Hitec Focus 4 radio, Main Planes* will configure this big trainer with your choice of engine and/or radio. The large wing folds in half, "door-hinge" style, for easy transportation. Finished with urethane paint, the Bush Bird Jr. includes aircraft-grade T-6 aluminum gear.

HOBBICO **SKYRUNNER**

New pilots of 12 years and older will enjoy the simplicity and proportional control engineered into the Hobbico Skyrunner. A single-stick radio introduces control functions that will carry over to more advanced radio setups. The Skyrunner's electric motor is powered by a rechargeable 6V battery pack, a 4-hour AC wall charger is included, and the extra battery pack minimizes ground time. With its 34-inch-wingspan, the Skyrunner ties for the smallest airplane in our survey. The plane is made out of a foam material, so it's light and durable.

MEGATECH **AIR STRIKE**

Here's a small, light, slow-flying model aimed at the first-time flier on a budget. Megatech's* Air Strike has a highly undercambered wing that's nearly 3 feet long. The 24-ounce geared electric swings a 7⅛ propeller and includes a battery-eliminator circuit (BEC), so there is no separate receiver flight pack. Recharging the Air Strike is a matter of connecting the Ni-Cd battery pack to the included peak-detecting charger. Because it can be plugged directly into your car's cigarette lighter, it is easy to recharge at the flying field.

■ TRAINERS

Manufacturer	Model	Configuration	Wingspan (in.)	Power	Radio	Covering	Weight (lb.)	List price
Hobbico	SkyRunner	High-wing	34	540 electric	2-channel	Film over foam	0.9	$299.99
Hobbico	Superstar 40 Select	High-wing	60	O.S. .40 LA	4-channel Futaba	MonoKote	5.5	$375.00
Main Planes	Bush Bird	High-wing	120	Magnum XL .46	Hitec Focus 4	Urethane	7.0	$435.00
Megatech	Air Strike	High-wing	34	Electric	3-channel Megatech	Foam	1.5	$170.00
Thunder Tiger	Tiger Trainer 40 SC	High-wing	61	*TT GP .42	Hitec Focus 4	Film	5.5	$299.99
Thunder Tiger	Tiger Trainer 60 SC	High-wing	73	TT GP .61	Hitec Focus 4	Film	6.5	$339.99

*Thunder Tiger

SPORT/PATTERN

THUNDER TIGER SPORT 40L SC

For the more experienced flier, this 56-inch-span, low-wing, sport/aerobatic airplane is balsa and plywood with vacuum-formed turtle deck and wingtips. The graphics are printed on its film covering. It comes with a Hitec Focus 4 radio and includes a large, semisymmetrical wing and installed Thunder Tiger GP .42 engine, a prop, glow plug, fuel tank, switch harness, servos and wheels. Simply join the wing halves, glue on the stabilizer, install the landing gear, fuel it up and go fly!

CERMARK BOBCAT 40

Intermediate and advanced pilots will particularly enjoy the smooth lines and pattern-like handling of the Bobcat 40. The highly visible yellow-and-black model is trimmed entirely in Ultracote covering. Its assembly is a little more involved than those of others in the survey, but it's not anything you can't accomplish after supper. You have to install the landing gear, attach your receiver, join the wing halves and mount the supplied aileron servo. The installed electronic gear is compatible with radio systems using Airtronics, Futaba, Hitec and JR connectors.

THUNDER TIGER CHAMPION 45S SC / RCP

For the intermediate flier who has recently graduated from a basic trainer, this 56⅕-inch-span mid-wing airplane is made of balsa and plywood and has a vacuum-formed plastic fuselage top and wingtips. It's a good plane for the aspiring pattern aerobatic flier. Join the wing halves, glue on the stabilizer, install the landing gear and head to the field! Running a ball-bearing Pro 46 engine, this RTF comes with a Hitec Focus 4 radio, but if you prefer to, you may buy it without the radio system for about $90 less (see comparison chart).

THUNDER TIGER CHAMPION 45L SC/RCP

For the intermediate to advanced flier, this 55½-inch-span low-wing airplane is made of balsa and plywood and has a vacuum-formed plastic fuselage top and wingtips; it also comes with a Hitec Focus 4 radio. The Champion 45L SC/RCP is a good plane for the Sunday flier who's interested in pattern and enjoys the tracking of a ship that can be trimmed to fly on rails. Assembly requires joining the wing halves, gluing on the stabilizer and installing the landing gear. Running a ball-bearing Pro .46 engine, this RTF is available in two versions: with and without a radio system (the latter will save you approximately $90—see comparison chart).

SPORT/PATTERN PLANES

Manufacturer	Model	Configuration	Wingspan (in.)	Power	Radio	Covering	Weight (lb.)	List price
Cermark	Bobcat 40	Low-wing	57	TT GP .42	Servos only	Ultracote	5.4	$299.99
Thunder Tiger	Tiger Sport 40L SC	Low-wing	56	TT GP .42	Hitec Focus 4	Film	5.4	$299.99
Thunder Tiger	Tiger Stick 40 SC	Shoulder-wing	58.5	TT Pro-40	Hitec Focus 4	Film	5.4	$319.99
Thunder Tiger	Tiger Stick 40 RCP	Shoulder-wing	58.5	TT Pro-40	No TX/RX	Film	5.4	$229.99
Thunder Tiger	Champion 45S SC	Mid-wing	56.2	TT Pro-46	Hitec Focus 4	Film	5.5	$369.99
Thunder Tiger	Champion 45S RCP	Mid-wing	56.2	TT Pro-46	No TX/RX	Film	5.5	$279.99
Thunder Tiger	Champion 45L SC	Low-wing	55.6	TT Pro-46	Hitec Focus 4	Film	6.0	$369.99
Thunder Tiger	Champion 45L RCP	Low-wing	55.6	TT Pro-46	No TX/RX	Film	6.0	$279.99

DUCTED FAN

Cox	XB-29 Airlifter	Mid-wing	50	Twin elec. ducted fan	2-channel Cox	Foam	.8	$219.99

THUNDER TIGER TIGER STICK 40 SC/RCP

For the sport flier, this 58½-inch-span shoulder-wing airplane is made of balsa and plywood, has vacuum-formed plastic wingtips and comes with a Hitec Focus 4 radio. To assemble it, you join the wing halves, glue on the stabilizer and install the landing gear. Running a ball-bearing Pro 40 engine, this RTF is also available without a radio transmitter or receiver (the "RCP" version, which costs approximately $90 less—see comparison chart).

DUCTED FAN

COX XB-29 AIRLIFTER

This ducted-fan twin is arguably the most unique airplane in our survey; the Cox* XB-29 Airlifter simulates a jet military transport aircraft. According to early reports, it will be the first commercially available model airplane to employ thrust vectoring as a primary flight control, i.e., right and left "electrofans" will be independently controllable; it will be powered by a 6V Ni-Cd battery pack. A 15-minute charger that can be plugged into your car's cigarette lighter will allow you to stay longer at the field. The Airlifter requires no glue or special tools and is sufficiently tame in flight to serve as a trainer.

GLIDERS

SR BATTERIES X440

Sport floater sailplane enthusiasts who appreciate fine craftsmanship may well see the 440 as the pinnacle of ready-built planes. This unusual aircraft features a fiberglass fuselage and carbon-fiber spars and leading edges. Its V-tail configuration is streamlined, sturdy and rugged. SR* will consult with you to create a personalized model, offering choices of red and yellow for the fuselage and transparent Carl Goldberg Ultracote Light wing covering. The 64-inch-span X440's plug-together wing allows easy transportation. SR offers several motor choices, including a Speed 400 system and, for hotter performance, an AP29 or Astro .020 brushless; any one of these may be paired with a Jeti electronic speed control. SR will customize servos and receiver combinations to suit your needs. Price depends on which motor, battery and radio combination you choose.

CERMARK EASY ELECTRO 72

Sunday fliers as well as beginners will enjoy the stable qualities and high lift generated by the Easy Electro 72's flat-bottom airfoil. This airplane does not come with transmitter and receiver. The polyhedral wingtip panels can be permanently joined or, for ease of transportation, configured so that they can be plugged in. The 40-inch-long fuselage of this powered glider/trainer is constructed of a sturdy ABS plastic and has integral molded cooling vents. Reviewed in the August '98 issue of *Model Airplane News,* we found its assembly would typically take about 20 minutes.

THUNDER TIGER WINDSTAR 2M EP SC/2M SC

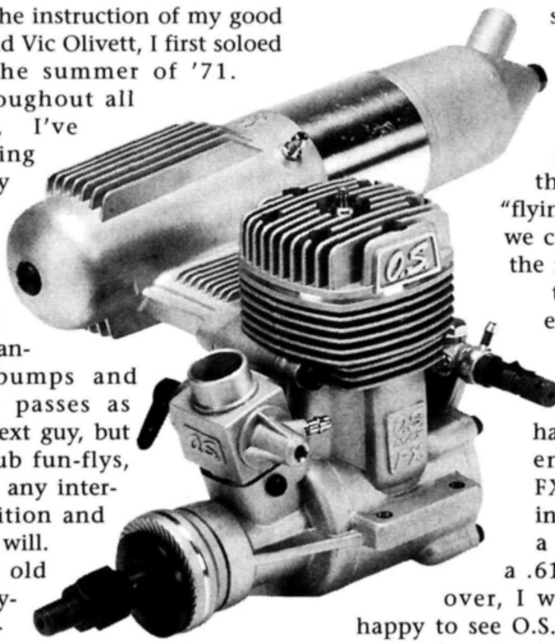
For the glider enthusiast who likes to thermal, this 2-meter sailplane is made of balsa and plywood and has vacuum-formed plastic wingtips. To assemble it, you simply join the wing halves and glue on the stabilizer. Charge it up and you're ready to soar using the Hitec Focus II SS radio. You may buy the Windstar as a powered glider or as a pure sailplane; both versions include transmitter and receiver (see comparison chart).

GLIDERS

Manufacturer	Model	Configuration	Wingspan (in.)	Power	Radio	Covering	Weight (lb.)	List price
Cermark	Easy Electro 72	Polyhedral low-wing	72	Mabuchi 550	Servos only	PVC	2.8	$229.00
SR Batteries	X440	Shoulder-wing	64	**Choice	Choice	Ultracote Light	1.5	$515.00
Thunder Tiger	Windstar 2M EP SC	High-wing	77.3	Mabuchi 540 PH	Hitec Focus II	Film	3.2	$319.96
Thunder Tiger	Windstar 2MSC	High-wing	77.3	Hand -launch	No TX/RX	Film	3.2	$199.96

**AP 29, Astro 020 brushless, or Speed 400

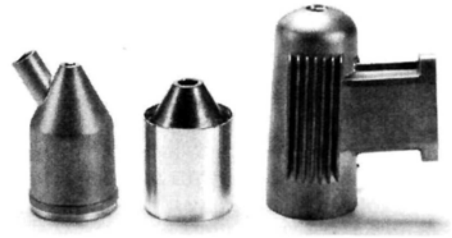
O.S. .91FX meeting the demands of larger sport models



With the instruction of my good friend Vic Olivett, I first soloed in the summer of '71. Throughout all those years, I've honed my flying skills to proudly become the quintessential sport flier I am today. Understand I like doing Cuban-8s, humpty-bumps and inverted low passes as much as the next guy, but other than club fun-flys, I've never had any interest in competition and probably never will.

Back in the old days (I love saying that), a .40-size model was considered the standard fare for the sport fliers. If you were one of the experienced, "senior sport fliers," you would grace the 1970's flight line with your .60-size pride and joy. Today, larger models are rapidly becoming the domain of the seasoned sport flier—especially those in the .90 2-stroke, 1.20 4-stroke category; generally speaking, models with wingspans in the 70- to 80-inch range. Models of this size start demonstrating the lovely quality of "flying on the wing," yet we can still get them to the flying field without the use of a converted boat trailer.

As a devout sport, sport/scale modeler, I was happy to see a .91-size engine join O.S.'s* FX line, which also includes a .25, a .40, a .46 and a .61. Moreover, I was very happy to see O.S. offer it as a ringed engine instead of an ABC type. Don't misunderstand; I like ABC piston-and-sleeve technology, particularly when it's true ABC and chrome plating is used. O.S. and certain other manufacturers use nickel instead of chrome. This works well but does not hold up like harder chrome.



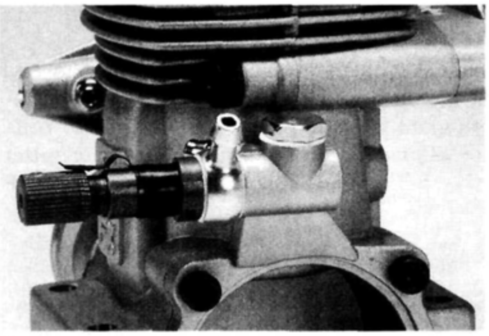
The large expansion-chamber muffler comprises three sections. The center section incorporates an internal baffle for enhanced silencing.

When I find a sport engine I really like—and I really like this new .91FX—I plan to keep it a very long time. So when rebuilding time comes (and, sooner or later, it will), all you need to buy with a ringed engine are the ring and a piece of wet/dry sandpaper and you're in business—that is, of course, providing you never seriously overheated the engine enough to warp the sleeve. With an ABC-type engine, rebuilding means purchasing a piston/sleeve matched set, which is

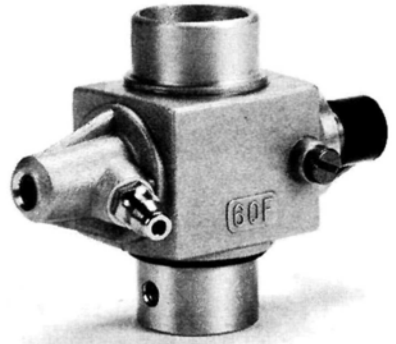
PERFORMANCE DATA

Prop	High-end rpm	Low-end rpm	Pull (lb.)
12x7	12,110	2,400	7.8
12x8	12,020	2,520	8.2
13x6	12,410	2,020	9.8
13x7	11,900	2,280	8.1
13x8	11,210	2,380	8.1
14x7	10,660	2,110	10.4

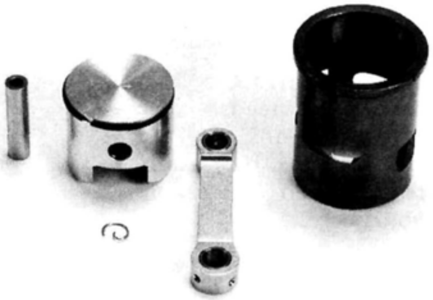
The .91 FX uses a two-piece locking prop nut like those found on 4-stroke engines.



Being part of the backplate casting, the remote high-end needle valve is a good distance from the prop—a fantastic safety feature I would like to see on all engines.



The carburetor incorporates a low-end needle adjustment for precise mid-range and idle mixture adjustment. While the spraybar is of conventional design and location, the fuel is metered at the valve at the rear of the engine and then transported to the carb via standard fuel tubing.



From right: wristpin; piston with single tension ring; wristpin retaining E-clip; connecting rod, which is equipped at both ends with bronze bushings and oil holes; hardened-steel cylinder sleeve.

This long main needle-valve extension is supplied with the engine. Thank you, O.S.

far more expensive.

Somewhere along the marketing-hype line, ringed engines seemed to get the "inferior technology" rap. Who knows why for sure? Maybe it's because for racing competition, ABC types are preferred; maybe it's because ringed engines do take a bit more breaking in than ABC types. So what? We're not talking major bench running here: just a few tanks' worth in the model on the ground (which also happens to be a good safety practice).

So much for my pontificating on the virtues of ringed pistons; on to the running of the .91FX ....

Conditions during running
Temperature: 76º F
Humidity: 22%
Elevation: 255 feet above sea level
Fuel used: 10% nitro, 18% oil (synthetic/castor mix)
Plug used: Hangar 9 no. 2 performance plug
Props used: APC
Tach used: TNC

Because the ring needs to seat with the sleeve, the first start-up will go a lot more easily with the application of an electric starter. After running three tanks of fuel (with the first very rich) through the engine on the ground (with cool-down periods) and running the next two tanks straight through with incremental leaning, I found that the ring started to seat, and hand-flipped start-ups were easily accomplished.

If the engine had been in a model, I feel it would have been fine to do the remainder of the break-in in the air with a rich, but sufficient, power-producing needle setting. For in-depth break-in procedures of ringed engines, I highly recommend Dave Gierke's book, "2-Stroke Glow Engines for R/C Aircraft" (available at hobby stores and from Air Age Publishing; see "Pilots' Mart" for ordering details).

As expected from an O.S. engine, after break-in, the .91 FX was extremely user-friendly. Overall running qualities were very pleasant, with needle settings not being critical and throttle response excellent. Transition to high throttle from the low idles recorded here (see "Performance Data" chart) was instantaneous. Also excellent was the overall vibration level; I hate vibration and so should you!

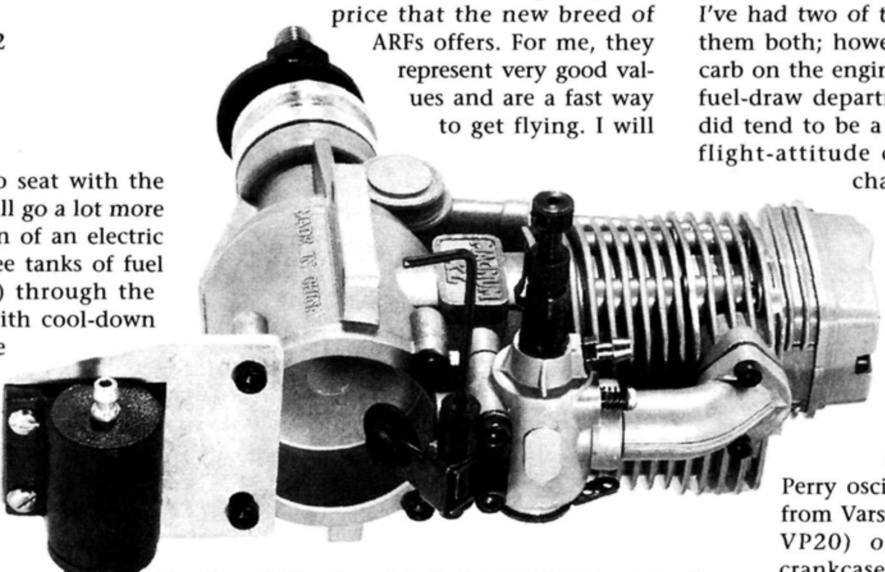
If you're like me and love 10- to 12-pound sport and scale models with about 1,000 square inches of area, you're going to love this latest addition to the FX line, and you're going to love the O.S. reliability that comes with it.

Q&A SESSION

Lou's original letter appeared in the August "Airwaves" section. I received a few emails asking me to further explain how I use the Perry VP 20 pump. Here are excerpts from Lou's first email and our follow-up correspondence. I include a photo, to leave no doubt.

Q: I have subscribed to *Model Airplane News* since 1956. Your article about the Spacewalker prompted me to purchase one, and I've put an old Enya 1204C into it.

Most often, I build from plans, so ARFs are not my forte, but this one seems to be very good on the whole. It is almost impossible to build to the level of quality and price that the new breed of ARFs offers. For me, they represent very good values and are a fast way to get flying. I will always scratch-build but will also have ARFs to round out my stable of weekly fliers.



The Enya 1.20 referred to in the text has front crankcase bolts I used to mount the Perry oscillating pump. Like O.S., the Magnum .91 (shown here) has a single-piece crankcase and no front bolts. Mounting the pump on the rear opposite the cylinder works equally well.

Here's my problem: the Enya 120R 4C goes rich as soon as I begin a climb-out. Then it's rich for the rest of the flight. It is also slow to respond to throttle input. I run Wildcat 15 percent with 18 percent oil, 80 to 20 percent synthetic/castor, a JOZ 15x8 prop and an O.S. type-F plug.

The tank location is good. I tried with and without muffler pressure—still the same result. I could understand if it went lean, but going rich is a new one to me. It tachs about 8,400 on the ground, and I back off to 8,000 to fly. I am afraid of setting it off too lean, and maybe I shouldn't be.

Lou Melancon

A: Thanks for the support, Lou. We do appreciate it; we surely do.

If your time is worth anything, ARFs truly are a great value. Here's another benefit: if you always have something ready or nearly ready to fly, there's no need to rush a building project to get into the air. Instead, you have the luxury of taking your time with a prized building project. As a result, it comes out lighter and straighter and is even safer because you took the time to do it right and check things such as control linkages two or three times the way we should.

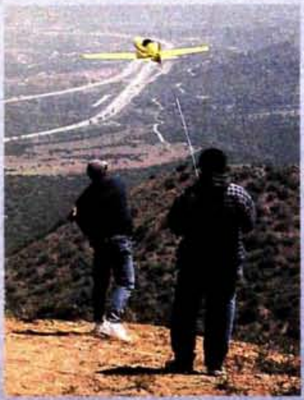
While Great Planes recommends a .91 4-stroke for the 79-span Spacewalker, I feel a good 1.20 like the Enya 1.20 4C is a perfect choice. While not quite as powerful as the "R" version of Enya's 1.20, it still has plenty of torque and will last almost forever if you give it proper care. I've had two of the 4C versions. I loved them both; however, the stock air-bleed carb on the engine was a bit weak in the fuel-draw department. As a result, they did tend to be a bit sensitive to aircraft flight-attitude change, which would change the in-flight mixture either lean or rich, depending on flight attitude. On high-G maneuvers, the engine would briefly sag or even quit on occasion during a snap roll. This problem was totally cured by mounting a Perry oscillating pump (available from Varsane Products*—part no. VP20) off the front of the crankcase opposite to the cylinder. I did this with both my 1.20 4Cs, and they worked like a charm from then on. In general, the Perry oscillating pump seems to help out many single-cylinder 4-strokers.

I have been informed by Altech Marketing* that the Enya 1.20 4C is now available with either the original air-bleed carb or a twin-needle type, which, by design, has a far better fuel draw. While air-bleed carbs are extremely simple to adjust, in my opinion, the concept of bleeding or leaking air to obtain a proper low-end fuel/air mixture is not the best way to go. I've never been a big fan of air-bleed carbs offered by any company. They do tend to degrade fuel draw.

Don't forget to have fun at the field Lou!

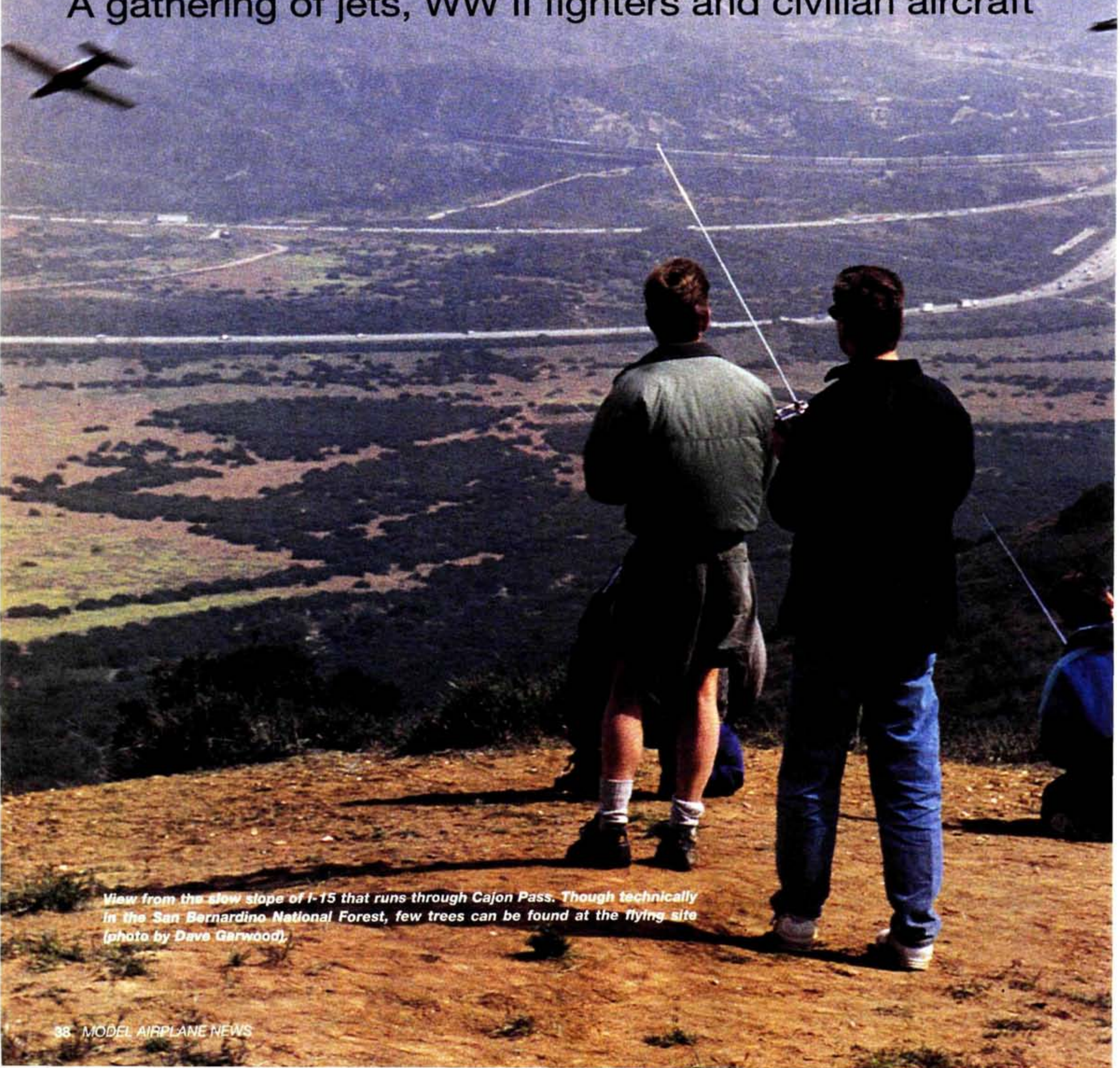
**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

Power Scale Sailplanes Over Cajon Summit



by Dave Garwood

A gathering of jets, WW II fighters and civilian aircraft



View from the slow slope of I-15 that runs through Cajon Pass. Though technically in the San Bernardino National Forest, few trees can be found at the flying site (photo by Dave Garwood).

POWER SCALE SOARING (PSS) has been around for a while; it's generally practiced in small groups or, at best, as part of a general scale sailplane gathering. Last year, the Inland Slope Rebels (ISR) Club in Riverside, CA, decided to have a pure PSS event. This was the second running of the event, and in my view, it has gathered enough steam to become a major component of the soaring scene.

Dave Wenzlick's original-design P-40 Warhawk, from EPP foam (photo by Dave Garwood).

A highly unusual model, this Sukhoi Su-25 Frogfoot in Celestial Hussians airshow team colors was molded by Carl Maas and built and flown by Brian Laird (photo by Dave Garwood).

A Lockheed T-33 jet trainer built and flown by Wade Kloos. It's an original design constructed out of EPP foam (photo by Joe Chovan).

THE SITE

Cajon Summit is about 80 miles northeast of the Los Angeles airport, out in the high desert country. The flying site itself is part of a several-miles-long ridge, 4,260 feet above sea level and about 1,000 feet above the valley floor.

The location is remarkable for its steady south winds that are created daily by the solar heating of the desert to the east that draws air from the coast, through Cajon Pass and right up this slope. Although access to the pass requires traveling over a few miles of rough dirt roads, and parking is limited, the trip is worth the effort. At one time or another during the weekend, four distinct types of R/C soaring were practiced: there was a slope for slow planes, a slope for fast planes, thermal hunting out over the valley and dynamic soaring between the two sites.

The weather was variable during the three-day event. In the summer, high desert conditions generally prevail: warm, sunny days and cool nights. On this weekend, a storm dropped down from the Gulf of Alaska and produced evening thunderstorms near the coast that resulted in cloudy conditions in the mountains on Friday and Saturday. It gave us fog banks to fly into and out of on Saturday morning and again in the evening. On Sunday, we were back to slapping on the sunblock and wearing floppy hats. Fortunately, we had plenty of wind.

This Poulon Special, built and flown by Steve Willcox, is an original design made out of EPP foam (photo by Joe Chovan).

Dave Sanders turns and burns with his large-scale EPP-foam P-51D Mustang built from a Wade Kloos kit (photos by Joe Chovan).

Lockheed P-80 Shooting Star built and flown by Brian Laird of Moreno Valley, CA. Judged Best Jet at the event, this original design has a molded-fiberglass fuselage, tip tanks and a sheeted-foam wing (photo by Dave Garwood).

AWARDS

Best WW II Model: Greg Matson, P-51D from Wade Kloos kit

Best Jet: Brian Laird, own-design P-80 Shooting Star

Best Civilian Plane: Steve Willcox, own-design EPP Glassair "Falcon"

Best Prop Plane: Carl Maas, F6F Hellcat from Slope Scale kit

Best Crash: Dennis Duncan

Pilots' Choice: Greg Matson, P-51D from Wade Kloos kit

THE PLANES

On a Southern California hill this good, you expect to see fiberglass and foam-wing warbirds and slope jets, and we saw plenty of them. The Slope Scale* iron horses spent plenty of time in the air and performed their trademark formation stall-turn routines. Jeff Fukushima flew a pair of big Lockheed T-33s and his F-18 Hornet in Blue Angels trim. There were a few ISR club-project Super Toucanos. Brian Laird and Carl Maas flew new molded T-33s in a slightly smaller scale, and my trusty traveling British Aerospace Hawk took to the air in its new paint scheme.

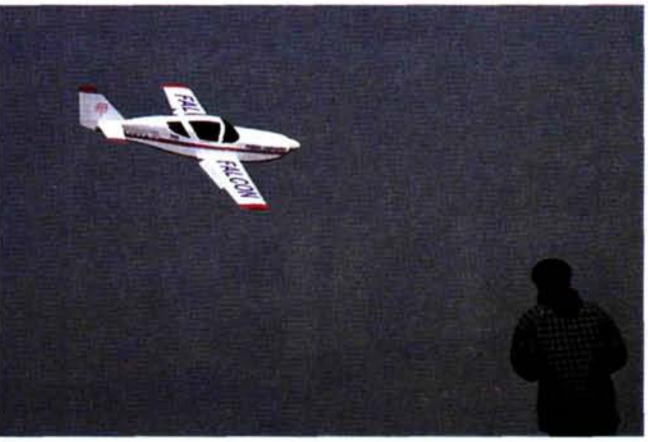
You might also expect to see small, highly detailed planes like Dave Wenzlick's F-16 Falcon converted from an E-Jets* kit and Greg Matson's immaculately detailed Me-163 Comet, also an E-Jets kit conversion. Both flew, but both were a handful in the air.

New on the scene this year were mini foamie warbirds from Steve Patton and Dave Sanders, tricked out in warpaint and looking every bit as good as their larger brothers, and just a blast to fly. Another great-looking and great-flying small EPP plane was Terry Trimble's North American F-86 Sabre, built from Gus Morfis* plans. And Steve Nelson's Douglas C-47 Skytrain, an original design in EPP foam, stays in my mind's eye.

The large-scale EPP foam planes, such as those from Wade Kloos, are impressive on the wing and offer tremendous opportunity for detailing. Indeed, Greg Matson's super detailing on his Durable Aircraft Models* P-51D Mustang earned him awards for both Best WW II and Pilots' Choice. Greg's plane featured display prop and landing gear, droppable tanks, remote-control sliding canopy and onboard machine-gun noises.

Perhaps the most impressive planes shown and flown at the gathering were large-scale EPP models. Dave Wenzlick started the trend last year with his winning, original-design Curtiss P-40 Warhawk that returned for this event. There is a lot of detail on Dave's plane, and it's difficult to tell it's a foamie.

This year, Steve Willcox's giant, 19-pound EPP Glassair Falcon wowed the crowd and took Best Civilian award. The finish and markings were flawless, and the plane flew well, often with flaps partly deployed. Steve also built and flew a Poulon Special that, when on the wing, looked like a fiberglass model.



This Glassair Falcon, a 19-pound EPP-foam original design built and flown by Steve Willcox, was judged Best Civilian model at the event (photo by Joe Chovan).

No one who has seen Wade Kloos' big blue Lockheed T-33 with tip tanks in blue Navy scheme can forget it. This big EPP bird got hours of air time and may become the next Durable Aircraft Models kit offering. The big news at Cajon Summit in 1999 was that foamies are not limited to simple lines and simple finish schemes. They can look as good as glass birds, and they offer a substantial increase in durability and resistance to damage when compared with traditionally constructed planes.

In my opinion, the single most interesting plane was a Sukhoi Su-25 Frogfoot, a ground-attack plane (tank killer) that was the Soviet counterpart to the Fairchild A-10 Warthog. Carl Maas made the four-quadrant mold, and Brian Laird built the first plane produced from the mold and finished it in the colors of the Soviet airshow team, the Celestial Hussians. This model is a technical achievement and, I'm happy to report, flew as well as Brian's and Carl's many other designs.

A major theme of this event was that *all* the planes flew. There weren't any hangar queens in this crowd.

Flying in a fog bank during the scale judging (photo by Dave Garwood).

THE PEOPLE

Fifty pilots came from Arizona, California, Oregon, Texas and New York. Many brought their wives and kids and spent one, two, or three days on-site. It's great to see old flying buddies and meet new ones, especially in a like-minded group of hardcore slope pilots.

Many thanks to the event organizers: Doug Blackburn, Brian Laird, Carl Maas, Richard Teller and the rest of the ISR crew. Special thanks to Leslie Laird, Lori Maas and Annette Wofford for keeping us fed.

The 1999 Southern California PSS Festival was a great trip and a memorable experience for me. For three days, we flew as much as we wanted to, saw more than we expected and discussed slope planes with leaders and innovators in the field. I hope to do it again next year. See you on Cajon Summit in 2000?

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

SPONSORS

Aerospace Composite Products
Air Age Publishing
Airtronics
Aveox Electric Flight Systems
B² Streamlines
Bob Smith Industries
Bowman's Hobbies
Carl Goldberg Models
Cavazos Sailplane Design
Dave's Aircraft Works
Dremel
Durable Aircraft Models
Edjer
Frank Cavazos Model Craft
Futaba Corp. of America
Gougeon Brothers Inc.
Hitec RCD
Hobby Lobby Intl.
Hobby Shack
MAD Aircraft
Midwest Products Inc.
MM GliderTech
Patton Aircraft
Pierce Aero Co.
Propwash Video
RC Modeler magazine
RPV Industries
Satellite City
Sig Mfg. Co. Inc.
Slickraft
Slope Scale
Tower Hobbies
Traplet Distribution
Vortec Models
Zona Tool Co.

DYNAFLITE

SUPER CUB

by Bob Joslyn

GETTING STARTED

I built the vertical fin and rudder framework out of $\frac{3}{8}$x$\frac{15}{16}$-inch balsa stock and used thin CA. The rudder top (balance tab) and base piece are four, $\frac{3}{32}$-inch die-cut balsa pieces laminated with medium CA. I sanded the edges of these two assemblies flat, then glued and pinned them into position against the rudder leading edge (LE). The rudder trailing edge (TE) is four pieces of $\frac{1}{8}$-inch, die-cut balsa laminated with Great Planes* Pro medium CA to make a $\frac{1}{4}$-inch TE. I sanded all the edges of this assembly flat and glued it into position with medium CA. I used some scrap $\frac{1}{16}$-inch balsa as shims to center this piece on the rudder LE. I cut and fitted the ribs out of $\frac{1}{8}$x$\frac{3}{8}$-inch balsa and glued them in place with thin CA. This finished the basic construction of the fin and rudder.

I removed the fin and rudder from the building board and marked a centerline on the fin TE and rudder LE. I like Robart* Hinge Points and used them for all the hinges. I marked and drilled the hinge locations with an $\frac{1}{8}$-inch drill and a Robart drill guide. I notched the LE of the rudder to recess the hinge-point knuckle, then temporarily joined the fin and rudder and sanded them to match the airfoils, as shown on the plans. Then I removed the rudder and shaped its LE as shown on the plans. This completed the fin/rudder construction.

I built and sanded the stabilizer and

A gentle giant

THE DYNAFLITE* PIPER PA-18 Super Cub—a sport model of this classic aircraft—should be a super hit with modelers who want to get into giant scale. The Super Cub is designed to accept a wide range of gas and glow powerplants, can be built with or without flaps and finished in a variety of scale color schemes. Because it has a detachable, two-piece D-tube wing, you don't need a van to transport the 104-inch-span model.

PHOTOS BY DEBRA SHARP AND BOB JOSLYN

The kit comes with all wooden parts; a molded, four-piece cowl; aluminum wing-joiner tube; clear windshield and side windows; functional wing struts; a tailwheel bracket; 1/4-inch steel landing gear; miscellaneous hardware; a photo-illustrated construction manual; and three pages of full-size plans. Although the Super Cub features conventional construction techniques and is a gentle flier, you should have some previous building experience before working on it.

elevators and hinged them the same way as I did the fin and rudder. The stabilizer has a laminated LE. Note that the stab center section requires a 3/8-inch space for the vertical fin to be fitted. I pinned some 3/8-inch scrap wood to the building board and built the center section around it, being careful not to glue the spacer to the stabilizer.

FUSELAGE ASSEMBLY

The fuselage is built out of die-cut balsa, plywood parts and balsa sticks. I started construction by building bulkheads C, E and F. I cut, fit and glued all the balsa pieces with thin CA and used medium CA on the required plywood doublers (bulkheads E and F).

Bulkhead C requires some special attention. The manual cautions you to study the plans carefully because you must install this bulkhead in the fuselage at an angle, and it must be built accurately to allow proper installation. I cut the two, $12\frac{19}{32}$-inch side pieces and pinned them to the building board, then cut, fit and pinned together the remaining balsa pieces. When I was satisfied that all parts fit properly and that the alignment was correct, I glued the balsa parts with thin CA and the plywood doublers with medium CA. All bulkheads were sanded smooth and square.

The fuselage sides are built in four sections. First, I built the right front fuselage side; it is made out of two plywood and four balsa die-cut pieces and is glued together with medium CA. I removed the right side from the plans, flipped it over and covered it with wax paper. I built the left front section directly over the right section.

The right rear side was built from balsa sticks and two die-cut plywood pieces (make sure to use the right-side pieces). The balsa was glued with thin CA, and the die-cut pieces were laminated with and glued into place with medium CA.

I pinned the right front section to the plans and attached it to the right rear section with medium CA. I added the die-cut, 1/8-inch balsa doublers with medium CA and marked the positions for the bulkheads, firewall and cross-braces on the inside of the fuselage side. I flipped this assembly over, covered it with wax paper and built the left side over the right in a similar fashion.

I made sure that bulkheads C and E were properly aligned before gluing them to the right side of the fuselage with 12-minute Tower Hobbies* epoxy, then positioned the 1/8-inch die-cut plywood lower deck piece.

I glued the left fuselage side to bulkheads C and E with 12-minute epoxy. This

SPECIFICATIONS

Model name: Piper PA-18 Super Cub

Manufacturer: Dynaflite

Type: giant sport-scale

Wingspan: 104 in.

Wing area: 1,571 sq. in.

Weight: 15 to 17 lb. (20 lb., as built)

Wing loading: 20.5 to 23.5 oz./sq. ft. (27.6 oz./sq. ft. as built)

Length: 67.25 in.

Engine used: U.S. Engines 25cc

Radio required: 4- to 6-channel with six to eight servos

Engine rec'd: 1.60 4-stroke or 25cc to 35cc gasoline/glow

Prop used: Zinger 18x6

List price: $279.99

Features: two-part D-tube wing; can be built with flaps; comes with a molded cowl; windshield and side windows; steel landing gear; wing struts; tailwheel bracket; aluminum wing-joiner tube.

Comments: the Super Cub is a good model for intermediate builders who want to get into the world of giant scale.

Hits
- Excellent overall wood quality.
- Very good plywood die cutting.
- Easy construction.
- Very good assembly manual with lots of photos and illustrations.

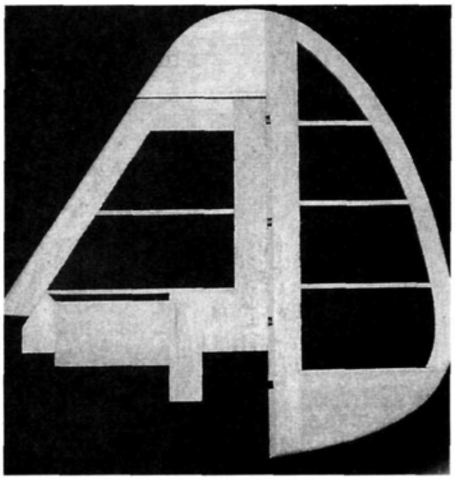
Misses
- Die-cut balsa-tip TE sheeting did not fit properly.

step was done over the plans to ensure proper alignment. After the epoxy had cured, I glued the lower deck in place with medium CA. I aligned and pinned the fuselage assembly over the plans and glued the tail together, then added bulkhead F, all the cross-bracing and the die-cut balsa cleats.

I used 30-minute epoxy to glue the ¼-inch-thick firewall in place and clamped it into position. I cut, fit and glued in the basswood doublers with 30-minute epoxy. After the epoxy had cured, I drilled several 1/16-inch-diameter holes through the fuselage sides, epoxied in 1/16-inch-diameter hardwood dowels and sanded them flush.

I added the ⅛-inch-thick die-cut plywood top deck, outer bulkheads C, B and A and a balsa stringer between bulkheads A and B. I sheeted the nose of the model with ⅛-inch balsa sheet.

I glued the plywood and basswood landing-gear parts in place with 12-minute epoxy. I added some ½-inch balsa triangle stock to this area for added strength. I added the front lower balsa sheeting and filled in the landing-gear area with ¼-inch balsa sheet. I sanded these areas to match



Vertical fin and rudder assembly.

the contour of the fuselage.

Dynaflite recommends that you build the ⅛-inch plywood radio box into the fuselage top even if you put the radio equipment in the tail. Note that the radio box floor has a notch in it; this goes to the left side of the fuselage.

I glued in the rear window-fairing pieces, the balsa side stringers and the framework for the left-side windows. The right window frame is built later. I added all the remaining stringers and bulkhead G. I notched the fuselage to accommodate a Klett* tailwheel steering assembly.

To balance the weight of the U.S. Engines* 25cc gasoline engine I had decided to use, I built a rear radio box into the fuselage. The instruction book provides the steps for this. This completes the basic fuselage.

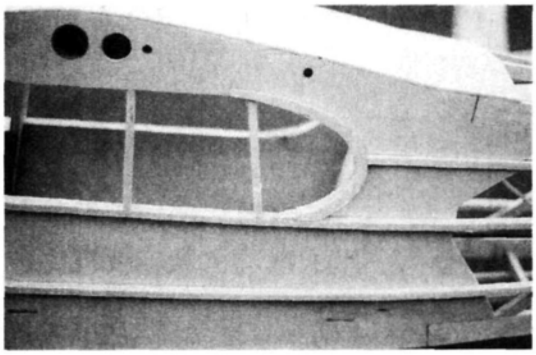
BUILDING THE WING

The two-piece wing has a few unique building sequences. I started wing construction by preparing all the LE skins out of 3/32-inch sheets. I also removed and prepared the die-cut wing, flap and aileron ribs. I decided not to laminate the ⅛-inch balsa die-cut wingtip bows. If you decide to build flaps, some building steps are skipped or added. Because there are quite a few steps (39!) in building the wing panel, I will not go into great detail about its construction.

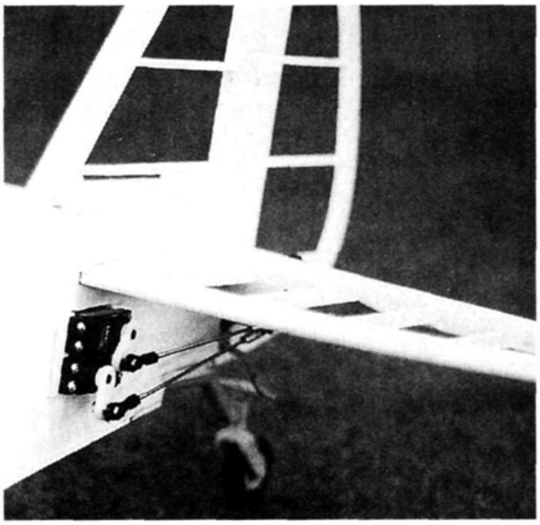
I built the right wing panel first. One problem I encountered was that the die-cut balsa tip TE sheeting did not match the plans and did not fit properly. I added some 3/32x¼-inch material to correct this. You have to build the left wing panel before you install the top sheeting because the wing-joiner tubes must be installed first.

Each wing panel has a 1-inch i.d. paper and a ¼-inch i.d. fiberglass wing-joiner tube built into it. A 1-inch o.d. aluminum tube and a ¼-inch o.d. steel rod are slid into the right wing panel. I slid the left wing panel into position, leaving the required 6¾-inch space between each panel. The wing panels were blocked as shown. I cut and fit ½-inch balsa triangle stock into place around the paper tubes and glued them with medium CA. I mixed up a slurry of 45-minute epoxy and Great Planes milled fiberglass and filled the rib bays around the paper tube in the right wing panel, then added the remaining shear webs. I rechecked the alignment of both panels and left the wing to dry. The left panel was then glued and allowed to dry. I glued in the ¼-inch fiberglass tubes with 12-minute epoxy.

I prepared the wing panels, flaps and ailerons for the top sheeting. I sanded the LE to match the airfoil shape of the ribs and sanded the shear webs flush with the top of the spars. I added the flap and aileron hinge blocks and shaped the flap and aileron LEs with a Great Planes Easy-Touch bar sander. I sheeted the top LE of each wing with the balsa skins I had prepared earlier, then sheeted the center sections, flaps and ailerons with 3/32-inch balsa.



Left side view showing window frame construction. The series of holes (left to right) over the window are for the aluminum wing-joiner tube, servo extension leads, wing-holding screw and steel joiner rod.



Left side showing rudder and left elevator servo.

FLIGHT PERFORMANCE

I set up all control surface throws as specified in the instructions and ran a couple of tankfuls of gas through the U.S. 25cc engine. I taxied the Super Cub around my backyard to check out ground handling and to see if there were any radio problems. Everything seemed to be OK, so off I went to the *flying field.*

• TAKEOFF AND LANDING

I taxied the Super Cub out onto the runway for the takeoff run. The ground handling was responsive, and tracking was very good. To maintain a straight takeoff, I had to add a little bit of right rudder to compensate for engine torque. The tail came up, and the Cub went down the centerline of the runway, gaining speed. I pulled back a little on elevator stick, and the plane rotated and became airborne. After climbing to a comfortable altitude, I checked out the trims. I needed a couple of clicks of up-elevator to trim the model for level flight.

On final approach, I carried some power and kept up the airspeed. After I had crossed the threshold, I cut engine power. The Super Cub slows down very quickly. I fed in a little up-elevator to control the descent, and the model touched down on its main gear. The rollout was maintained in a straight line with the use of rudder, and the tail settled down as the model slowed.

• HIGH-SPEED FLIGHT

Even though the Super Cub is not a speed demon, it did move along quite well at full throttle and tracked a straight line very well. All controls were set up as per the manual. These settings provided good control and were not overly sensitive.

Cross-wind handling is similar to that of a full-scale aircraft: use enough up-aileron into the wind to control drift and enough opposite rudder to maintain your track.

• LOW-SPEED FLIGHT

The Cub's low-speed handling characteristics were very good. The ailerons remained effective, although a little sluggish, during a slow pass with just a little bit of up-elevator to keep the model in level flight. Slow flight with flaps down required a little more power and up-elevator to overcome the extra drag. The rudder remains very effective at slow speeds and should be used if airspeed is too slow for the ailerons to be effective.

Right and left stall turns were clean with the model pivoting around its wingtip.

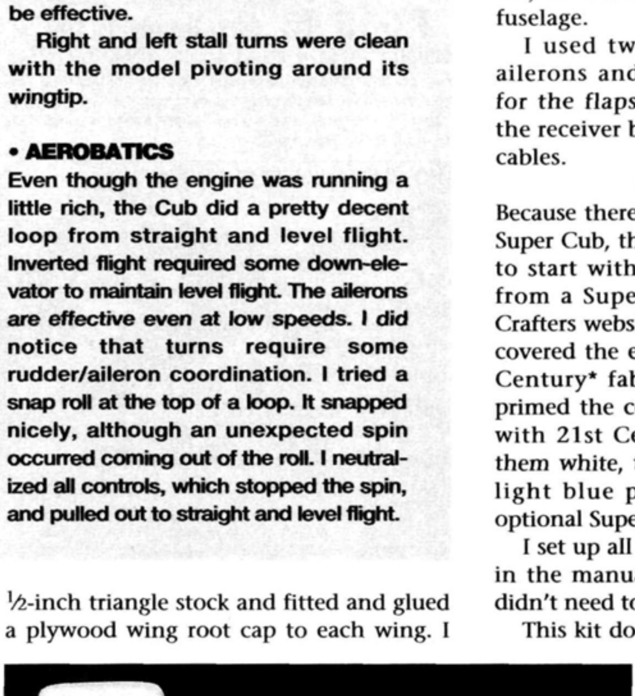
• AEROBATICS

Even though the engine was running a little rich, the Cub did a pretty decent loop from straight and level flight. Inverted flight required some down-elevator to maintain level flight. The ailerons are effective even at low speeds. I did notice that turns require some rudder/aileron coordination. I tried a snap roll at the top of a loop. It snapped nicely, although an unexpected spin occurred coming out of the roll. I neutralized all controls, which stopped the spin, and pulled out to straight and level flight.

I finished the wing panels by installing the servo rails. After mounting the servos, I added 3/32-inch sheeting around them. I installed paper mailing tubes in the panels to act as guides for the servo leads and glued on the 3/32-inch capstrips with medium CA. I then rough-sanded the wing panels to shape.

The wing is now fitted to the fuselage. The paper and fiberglass tubes are fitted into the fuselage center section. The wing is mounted with the aluminum tube and steel rod. I checked the wing for proper alignment with the fuselage and, when I was satisfied, I glued both tubes in place with a mixture of 30-minute epoxy and milled fiberglass.

After the epoxy cured, I removed the wings and reinforced the paper tube with 1/2-inch triangle stock and fitted and glued a plywood wing root cap to each wing. I shaped the LEs of the flaps as shown on the plan, drilled the hinge holes and added the control horns. I temporarily mounted the flaps to the wing.



The optional cockpit kit available from Dynaflite is a great way to dress up your Cub and looks very scale when completed.

I finished up the fuselage by adding the windshield braces, sheeting and tail blocks and rough-sanded it to shape. I built the right window frame out of 1/8-inch stock, then cut out the molded windshield and fit it to the fuselage.

I mounted the engine to the fuselage with a Great Planes isolated engine mount to reduce engine vibration. I assembled the plastic cowl with thin CA and fit it around the engine and installed a 16-ounce Du-Bro* tank with a gasoline stopper and Sullivan* fueling valve.

I silver-soldered the landing gear together, fit 1/4-inch balsa sheet between the wires and then fiberglassed over the sheet.

I finished up the fuselage assembly by mounting the tail feathers, making the wing struts and mounting the Klett tailwheel assembly. I installed an EMS* 1200mAh battery pack, receiver, three Hitec* HS-545B servos (two for elevator, one for rudder), one Futaba* S133 (throttle), switch and a servo reverser (elevator) in the radio box in the tail of the fuselage.

I used two HS-545B servos for the ailerons and two JR* NES-L501 servos for the flaps. These were connected to the receiver by two homemade extension cables.

FINISHING UP

Because there are so many versions of the Super Cub, this kit does make a good base to start with. I chose my color scheme from a Super Cub I found in the Cub Crafters website (http://cubcrafters.com). I covered the entire model with white 21st Century* fabric with light blue trim. I primed the cowl, landing gear and struts with 21st Century primer and sprayed them white, then trimmed the cowl with light blue paint. I also installed the optional Super Cub cockpit kit.

I set up all the control throws as shown in the manual, then checked the CG; it didn't need to be adjusted.

This kit does require some construction experience, but it's not hard to build and comes with a very good assembly manual that has a lot of photos and illustrations. An important feature is that the model will accept a wide range of glow- and gas-powered engines, and the optional flaps are a nice touch.

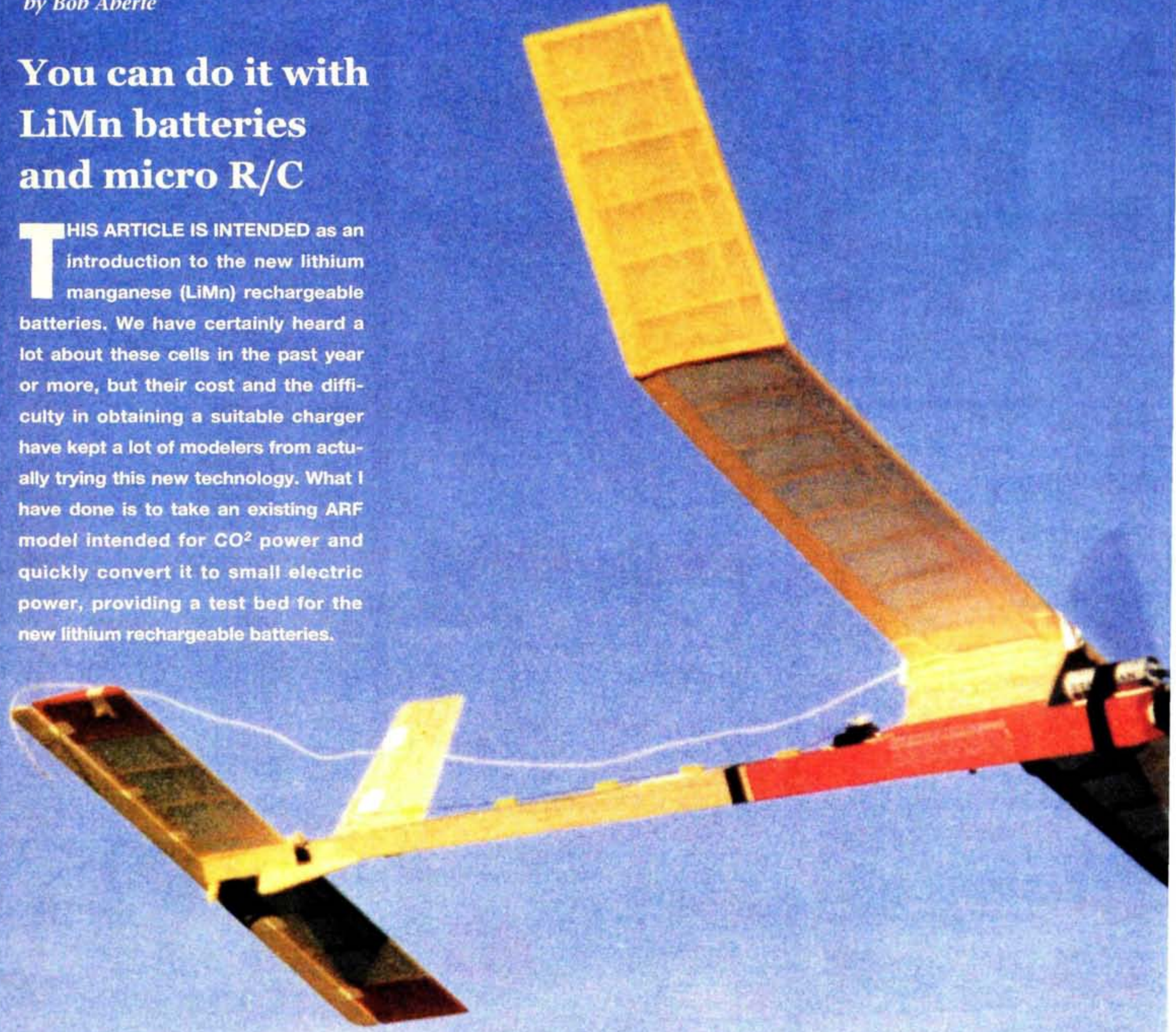
**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

A ONE-HOUR

by Bob Aberle

You can do it with LiMn batteries and micro R/C

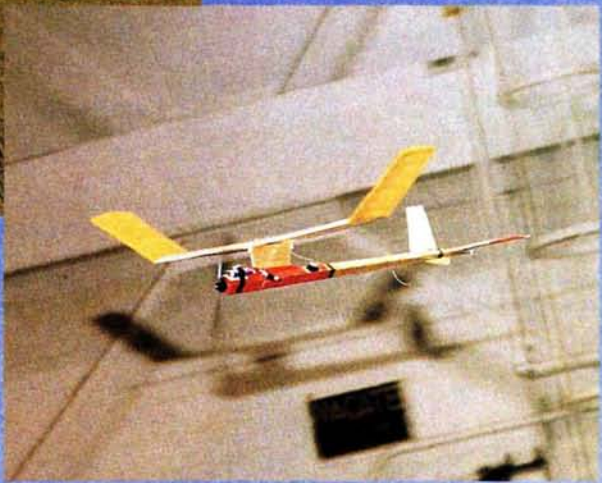
THIS ARTICLE IS INTENDED as an introduction to the new lithium manganese (LiMn) rechargeable batteries. We have certainly heard a lot about these cells in the past year or more, but their cost and the difficulty in obtaining a suitable charger have kept a lot of modelers from actually trying this new technology. What I have done is to take an existing ARF model intended for CO^2 power and quickly convert it to small electric power, providing a test bed for the new lithium rechargeable batteries.



The model featured in this article is the popular AIKA ARF, built in the Czech Republic and sold in the U.S. by Hobby Club Inc.* The little AIKA comes all framed in balsa with a tissue-like covering. At 128 square inches, it is quite small. I originally flew this model with a GM-120 CO^2 engine and a CETO single-channel (rudder-only) micro R/C system. Total weight at the time was 2.7 ounces. Like most CO^2 engines, the GM-120 could not be throttled. That lack of a throttle or engine control along with rudder-only flight control made it quite difficult to fly in an indoor environment.

The basic idea of my conversion scheme was to produce a plane with a motor throttle, rudder and elevator control that did not weigh much more than when it had the CO^2 engine installed. I was able to end up with those desired features in a model that weighed just 4.6 ounces. That produced a very respectable wing loading of only 5.2 ounces per square foot. Included in that 4.6-ounce total weight were two of the new Tadiran LiMn rechargeable battery cells (available from David Lewis*). The bonus of using this particular new battery is a flight time per charge of at least 1 hour. Hence, small model; long flights!

FLIGHT ON ONE CHARGE?



PHOTOS BY BOB ABERLE & TOM HUNT

MOTOR AND BATTERY COMBINATION
The first item to select in this conversion process was the electric motor. Thanks to a very complete motor data table prepared by Dick Miller (see his website at www.enter.net/rcm65/motdata.html), I was able to easily select a VL Products* HY-50B electric motor, which is supplied with a 5:1 gearbox. This motor is also available from John Worth at Cloud-9 R/C*. My selection was based on using a 6V power source, which is the characteristic voltage of two lithium rechargeable batteries connected in series. The HY-50B was claimed to swing a 7.25x4.50 VL Products black prop at 2,700 to 2,900rpm while drawing 0.8 amp of current. Dick's figures stated that this combination was capable of flying a 6.3-ounce (total weight) model with up to 229 square inches of wing area. As it turned out, the HY-50B proved that it had more than enough power to fly my 4.6-ounce model of 128 square inches. The motor current turned out to be exactly 0.8 amp, and the prop speed was 2,700rpm.

The next trick was to select a battery that would supply around 6 volts to the VL Products motor. I could have used a 6-cell, 150mAh Ni-Cd battery pack, but that

SPECIFICATIONS

Model: AIKA Electric Conversion

Wingspan: 32 in.

Wing chord: 4 in.

Wing area: 128 sq. in.

Total weight: 4.6 oz.

Wing loading: 5.2 oz./sq. ft.

Length: 25 in.

Channels: three (rudder, elevator and motor)

Motor used: VL Products HY-50B, geared 5:1

Prop: VL Products 7.25x4.50

Battery: Tadiran LiMn rechargeable cells (two)

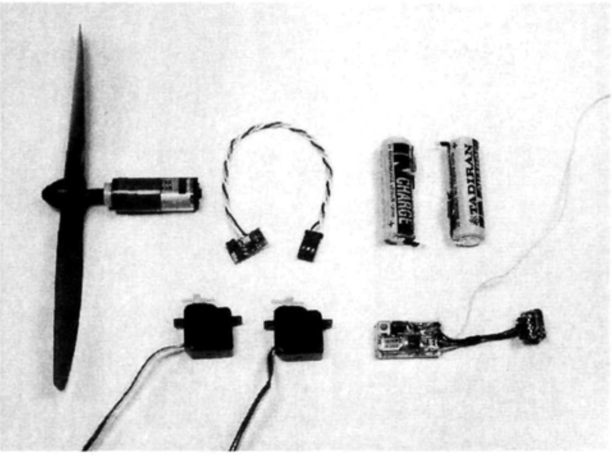
ESC: Castle Creations Pixie-Lite (high-voltage cutoff)

Flight time: in excess of 1 hour on a charge

would have weighed 2.1 ounces and would have provided only a 10-minute motor-run time. Instead, I made a bold move and invested in two of the new Tadiran lithium metal rechargeable battery cells. Each cell costs $12.50, has a rating of 850mAh, the physical size of an AA cell and weighs 0.7 ounce. As already stated, the characteristic voltage of each cell is 3 volts, so only two in series would give me my 6 volts. At 850mAh capacity, my flying time would be up to around 1 full hour, yet the 2-cell battery weight would be 0.7 ounce lighter than the 6-cell 150mAh Ni-Cd pack.

I might mention as a side note that Tadiran recently introduced a ½-size lithium cell that's ⅔ the size of an AA cell and has a capacity rating of 430mAh. It weighs just 0.4 ounce and has the same voltage characteristics but, unfortunately, this cell is more expensive than the larger 850mAh cells. Using these cells, the AIKA would weigh 4 ounces and fly for approximately 30 minutes.

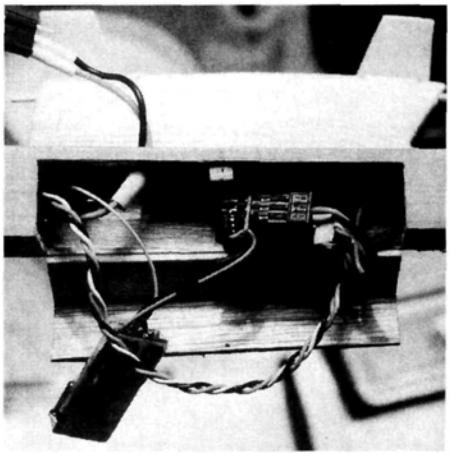
There are, however, several drawbacks to using the new lithium rechargeables. First, they can only be charged to a peak voltage of 3.4 volts per cell or, in my case, 6.80 volts peak for 2 cells in series. Also, you can discharge these cells only to a minimum of 2 volts per cell (4 volts, in my case). Failure to keep the lithium cells below 6.80 volts and above 4 volts can damage them. I'll talk more about the necessary charging techniques later.



The basic components that contributed to the electric conversion (top, left to right): VL Products HY-50B electric motor with 5:1 gearbox and VL 7.25x4.50 prop, the Castle Creations Pixie-Lite ESC and two Tadiran LiMn rechargeable battery cells; (bottom, left to right): two Hitec HS-50 Feather servos and the Garrett FM 4-channel receiver.

R/C SYSTEM

I obviously needed the smallest and most lightweight R/C components available for this application. For a receiver, I tried the new micro receiver from Paul Garrett Receivers* (it's also available from David Lewis). Paul's single conversion circuit has 4, full-channel-control capability and yet weighs just 0.2 ounce, including a small connector block attached to the end of

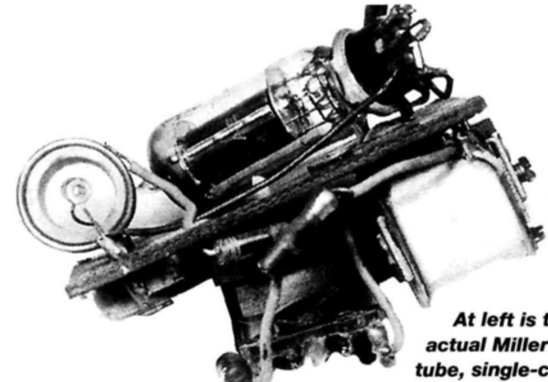


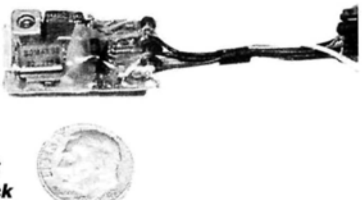
The AIKA comes with a small radio compartment door. Servo cables come from the right side and are plugged into the Garrett receiver connector block. The loose cable with the Deans three-pin connector is plugged into the battery pack.

a 1½-inch-long pigtail lead. The Garrett receiver measures 1⅛x⅝x5⁄16 inches. It isn't very narrowband in performance, so several channels generally have to be blocked out on either side of the operating frequency. But in a controlled environment and operating with similar equipment, this hasn't proved to be a problem at all. The stated radio range is approximately 300 feet, which isn't a whole lot. In my ground tests, I obtained 360 feet of solid control before the receiver started glitching. This would probably be a little more when the model is airborne, and when you consider the size of the models being flown, 300 feet of control won't give you any real problems.

The Garrett works well when controlled by most modern FM R/C transmitters. That is true regardless of high or low FM deviation. The small connector block will accept most modern servo connectors; just be careful of the servo-plug wiring. Make sure the negative power lead goes to the black wire on the terminal block. The red positive lead is in the center or middle position while the signal lead goes to any one of four colors, as follows: orange (aileron or rudder depending on application), green (throttle or motor controller), blue (elevator) and purple (rudder). My servos have the older style Airtronics servo connectors, and I was forced to trim the plastic connector housings to fit them to the very closely spaced pins on the Garrett connector block. During flight, the Garrett receiver performed well, didn't glitch and seemed to always have enough range to maintain control of the AIKA.

My choice for the servos was the new Hitec* HS-50 "Feather" sub-micro units. The HS-50 is certainly a tiny servo, to say the least; it weighs something like 0.2 ounce. Two of these servos were used: one for rudder control and the other for eleva-





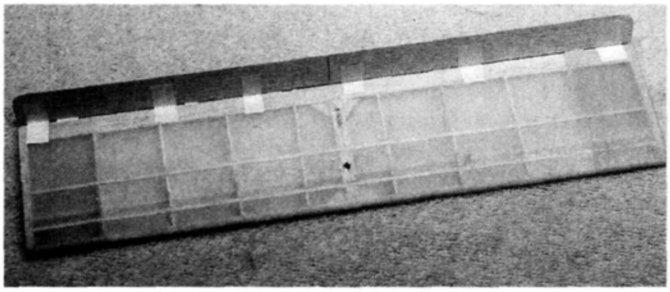
At left is the actual Miller hard-tube, single-channel receiver that the author built from Model Airplane News plans back in 1953. That receiver weighed 4.5 ounces and required both 1.5V filament voltage as well as 67½ volts to provide plate power. In comparison, the 1999 Paul Garrett FM, superhet, single-conversion 4-channel receiver works off two, 3V lithium rechargeable batteries, and best of all, weighs just 0.2 ounce!

tor. As tiny as they are, the HS-50s are well-made, have good speed and surprisingly good resolution. Only a single type of output arm is provided by Hitec, and it is very small. I could have used more rudder control, but there was no way to do that with the small output arm.

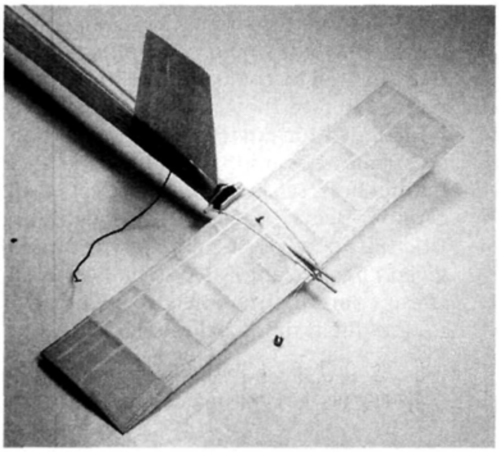
Current drain at idle for the Garrett receiver and the two HS-50 servos was 26mA. With both servos in motion, the total R/C system current can peak at about 150mA. If you add that to the total motor current, you get about 950mA peak total current. Because the battery has a capacity rating of 850mAh, you should be able to obtain flight times of close to one hour.

Another new item I tried was the Pixie-Lite electric motor speed controller (ESC) manufactured by Pat DelCastillo of Castle Creations*. Pat's little controller is thoughtfully provided only with a pigtail servo lead that is plugged into the throttle port on your R/C receiver. Then, using the provided wire chart, you select a wire of a gauge that's just enough to handle the current for your application. For my purposes, the current requirement was about 1 amp. I chose no. 22 stranded wire (RadioShack no. 278-1224)—probably overkill—because that was the lightest available from that source of supply.

Pat offers two models of his Pixie-Lite. One has a low-voltage cutoff of 3.5 volts, which is great if you are only using 5 cells to begin with. He also offers a high-voltage version where the cutoff is set at 4.5 volts. This is perfect for this application. Keep in mind that the lithium rechargeable cells don't like to go below 2 volts per cell (or 4 volts for two connected in series). With the Pixie-Lite high-voltage cutoff, the motor will stop running when the voltage gets to 4.5 volts; this is still way above the 4 volts allowable level. So when gathering your components, make sure that you get this specific model from Castle Creations.



A 5/8-inch-wide elevator made of 1/16-inch balsa was added. It was attached with hinges made from sticky-back covering material.



As originally supplied, the AIKA has a "loose" stab that's attached with rubber bands, just like the wing. During the electric-conversion process, this stab was permanently cemented into place.

AIKA PLANE MODIFICATIONS

Few changes to the AIKA model were really necessary. First, I added a 5/8-inch-wide elevator to the total span of the stab. I made the elevator out of 1/16 balsa and hinged it with some sticky-back covering material. The elevator control horn was made out of a small piece of 1/32 plywood. Because the stab was removable on the CO^2-powered AIKA, you need to cement the stab to the fuselage with thick CA.

Next, I mounted my two HS-50 servos. Just make cutouts in the balsa fuselage sides and add small pieces of 1/16x1/4-inch spruce to accept the servo-mounting screws. Try to position the servos just aft of the AIKA radio compartment door so that you can still access both servo cables. For control rods, I used 0.030-inch-diameter music wire supported by small lengths of the yellow or inner Sullivan* Gold-N-Rods. Just space out six or seven of these lengths of tubing along the full length of each control wire and cement them in place. Z-bends were used at both ends of the wire. I would have preferred Du-Bro* E-Z connectors, but as yet, they haven't made them small enough for this application.

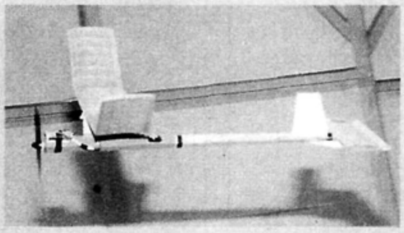
The VL Products HY-50B motor is so easy to mount you won't believe it. Just drill a hole in the center of the plywood firewall. You can start with 1/8-inch diameter and then enlarge the hole with a tapered ream until the threaded portion of the motor mount just fits into the hole. At this point, warm up your soldering iron and, following Castle Creations' instructions, wire the Pixie-Lite ESC to the motor terminals. Solder the battery wires as well, but leave them extra long at this point. Holding the motor and ESC in your hand, pass them through the receiver compartment door and all the way forward toward the firewall. Fish the threaded shaft out through the hole and tighten it with the plastic nut supplied by VL Products.

Cut down the battery wires and attach a Deans* three-pin female connector to it. Next place the two Tadiran lithium rechargeable battery cells up by the nose

FLIGHT PERFORMANCE

The little AIKA electric conversion's first flights were performed indoors at an aerospace company hangar that measured 100 feet square with a 30-foot ceiling. My buddy Tom Hunt did the honors, since I couldn't gain access to the facility.

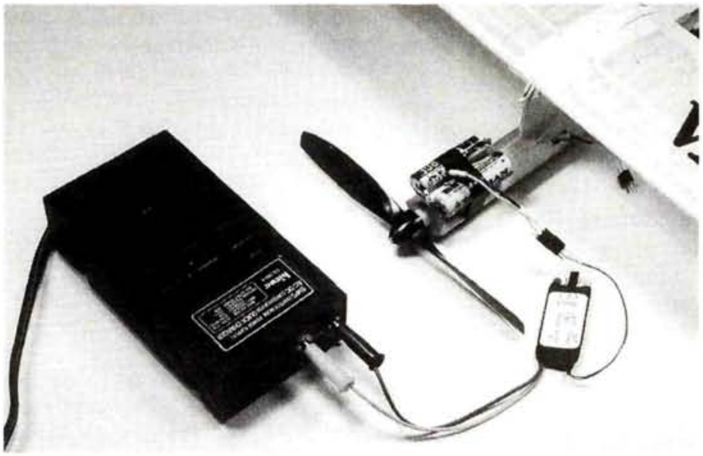
There was more than enough power to quickly achieve ceiling altitude. Close to full throttle was needed to sustain flight, but as the flight went on, Tom was able to cut back on power and let the AIKA settle back. Essentially, the average power level equated to something less than full power. When this first flight was over, Tom had logged 64 minutes and 50 seconds. My prediction of a 1-hour flight was right on! At the conclusion of the flight, I measured the voltage at about 5.2. Although the minimum voltage of 4 was not reached, Tom indicated that the model simply ran out of flight power and almost landed by itself. So, going below that minimum may not prove a concern.



The next morning, I tried flying the AIKA outdoors at sunrise with about a 5mph wind. The AIKA handled well. The CG might be moved a little aft, and the rudder could use more throw. On slow fliers, it is important to have a large rudder and to move it considerably either side of the neutral position. Failure to do this will prompt a somewhat sluggish flight that might even upset a beginner pilot.

Just remember that your radio range is only 300 feet or so. These tiny receivers lack some of the sensitivity of their big brothers. Don't show off and go for really high altitude; you might not get the chance to shoot a landing.

and just to the rear of the firewall. I used some double-sided tape and black electrical tape to hold both cells in place. Wire the cells in series. Solder a Deans male three-pin connector onto the cable that exits the battery. Last, plug the servos and the ESC into the Garrett receiver connector block, and pass the receiver antenna



Using the JMP LiMn charger is simple: connect the input to a 12V DC power supply like this one from Hitec. The output of the JMP charger goes to the two Tadiran lithium batteries.

out through the side of the fuselage and then out to the tip of the stab. I like to get the antenna away from the two wire control rods.

Final balance point was at about 50 percent of the wing. Rudder control throw was measured at ½ inch on either side of neutral, and elevator movement, 3/16 inch on either side of neutral. Total flying weight was 4.6 ounces.

CHARGING CONSIDERATIONS

The key to proper use of LiMn rechargeable batteries is the charger. You can't use just any charger; it must be limited in output to 70 to 80mA, and it must not allow the peak voltage under charge to exceed 3.4 volts per cell. This means that a special-purpose charger is a must. I'm convinced that within the next few months, several relatively inexpensive lithium battery chargers will hit the U.S. hobby market. I know that Ralph Weaver, the NEAC president, is working on one; my good friend George Steiner, another modeler, is working on the problem, too. David Lewis offers a charger kit designed by Bob Selman that costs only $8, but it charges only 1 cell at a time. Buying two of these for $16 isn't too much to complain about, though.

In my "travels," I contacted the German Wes-Technik website (http:/www.idnet.de/homepage/scholl/Englisch/news.htm), where I found a reference to a LiMn microprocessor charger designed by J.M. Piednoir of France. The charger accepts input voltages of from 8 to 14 volts and will charge 1, 2, or 3 cells, which you manually select with a small shorting plug. Regardless of the cell count you select, the charger will automatically turn off when the charge voltage reaches 3.4 volts per cell.

I bought one of these JMP chargers from a British company, RCS Technik*, for about $60 U.S., and it arrived in just four days.

The JMP charger is simplicity itself. You attach it to a 12V DC source (either a car battery or a small power supply). The red LED will flash initially (don't get nervous, it takes a few seconds the first time!). Select the number of cells you are charging, and set the shorting plug to the position indicated. Then attach the charger to the Tadiran battery, at which point the red LED will glow steadily. If your cells were low, it could take 9 to 14 hours to fully charge them. Just before full charge is reached, the green LED will start to flash (at first slowly, then progressively faster). At full charge, the charger will turn off while the red LED goes out and the green LED glows continuously. When I did this with 2 cells, I measured the cutoff at 6.79 volts ... 6.81 volts ... always very close. One thing I should mention is that I removed the supplied output connector and replaced it with a Deans three-pin female connector.

ENDLESS POSSIBILITIES

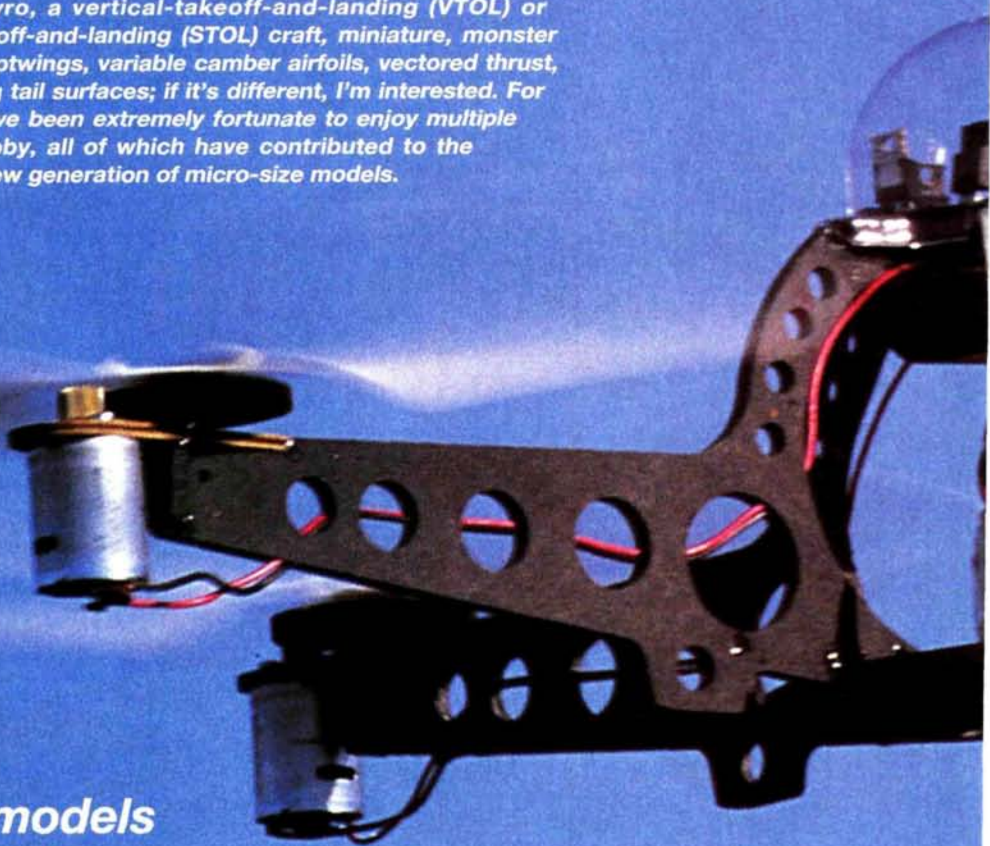
I think I proved my point with this proof-of-concept experiment. The new LiMn rechargeable batteries offer a great advantage for the indoor electric R/C enthusiast and even for outdoor parking-lot flying in mild wind conditions. Using the same components as I did for this project, I feel a target weight of up to 5 ounces is practical. It also occurs to me that a somewhat larger wing area would be helpful, trusting that the weight could still be limited to 5 ounces. In fact, the AIKA was not originally designed for anything but CO^2 power, so structure weight wasn't of a critical nature. I can see an entire "fleet" of small, 5-ounce scale model projects evolving from this power system, battery technology and lightweight R/C system. Best of all, these components will also give you 1 hour of flight time—believe it!

Addresses are listed alphabetically in the Index of Manufacturers on page 134.

THE NEW
IN LIGHTWEIGHT

by David C. Baron

Nothing intrigues me more than an unconventional flying machine. It doesn't matter whether the model is an autogyro, a vertical-takeoff-and-landing (VTOL) or short-takeoff-and-landing (STOL) craft, miniature, monster or tailless, has variable sweptwings, variable camber airfoils, vectored thrust, full flying wings or full flying tail surfaces; if it's different, I'm interested. For the last five years, we have been extremely fortunate to enjoy multiple revolutions in our hobby, all of which have contributed to the emergence of a new generation of micro-size models.



Unique small models from Area Fifty-One, Hobby Lobby and WattAge

IFO (INDOOR FLYING OBJECT)

Manufacturer: Dan Kreigh; distributed by Hobby Lobby Intl.

Type: slow flier

Wingspan: 33 in.

Wing area: 589 sq. in.

Weight: 6 oz.

Wing loading: 1.5 oz./sq. ft.

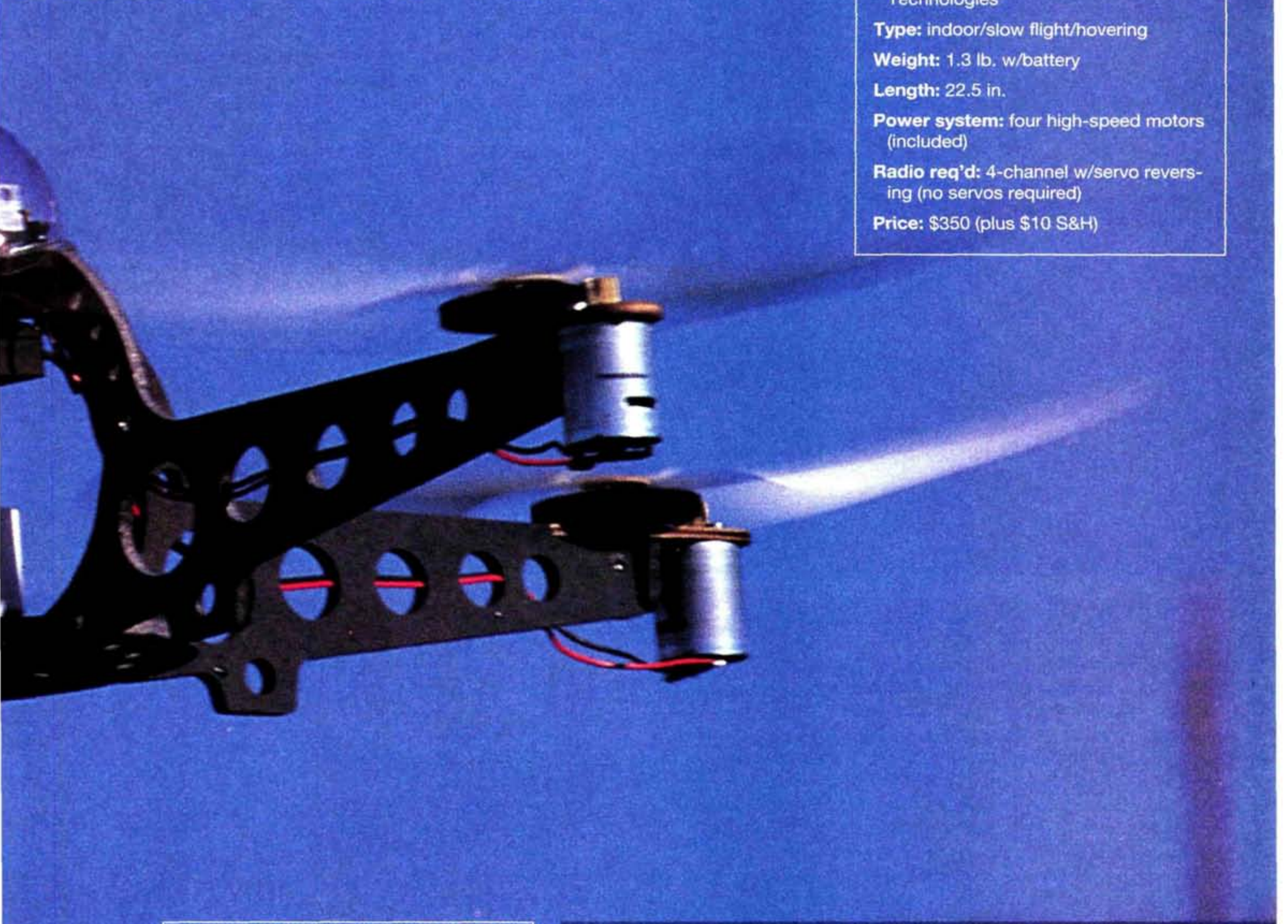
Motor package: Speed 280 geared drive system with 3-blade prop (part no. JH280145)

Radio req'd: 3-channel

Price: $49.90 (IFO), $29.90 (motor package)

GENERATION

ELECTRIC R/C



ROSWELL FLYER

Manufacturer: Area Fifty-One Technologies

Type: indoor/slow flight/hovering

Weight: 1.3 lb. w/battery

Length: 22.5 in.

Power system: four high-speed motors (included)

Radio req'd: 4-channel w/servo reversing (no servos required)

Price: $350 (plus $10 S&H)

B2 STEALTH BOMBER

Manufacturer: WattAge (distributed by Global Hobby Dist.)

Type: park flier/stand-off scale

Wingspan: 33.8 in.

Wing area: 197 sq. in.

Weight: 4.95 oz.

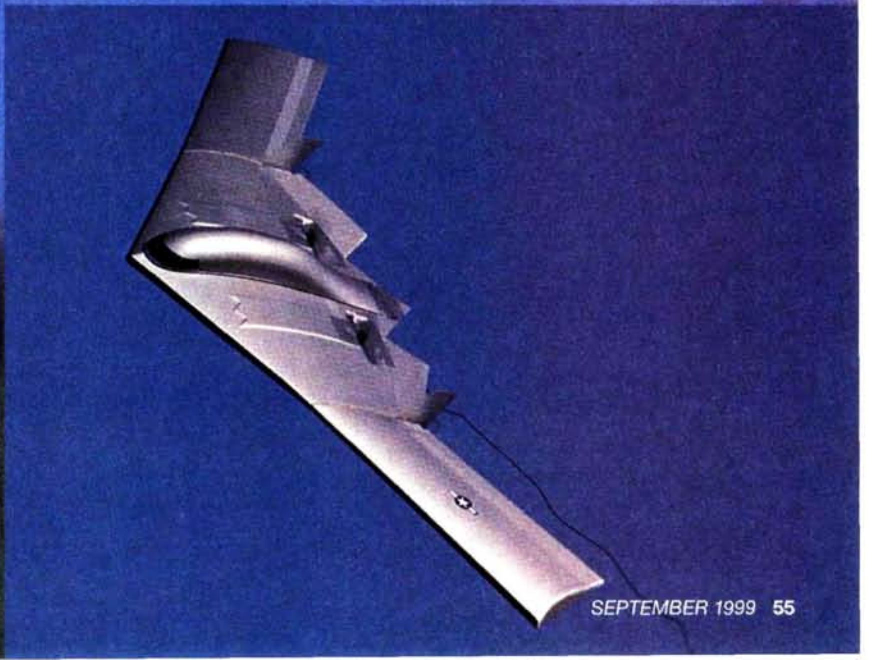
Wing loading: 3.61 oz./sq. ft.

Length: 14.9 in.

Motor system: two high-efficiency micro motors (included) and 4- to 6-cell battery pack

Radio req'd: 2- or 3-channel (optional throttle)

Price: $39.99

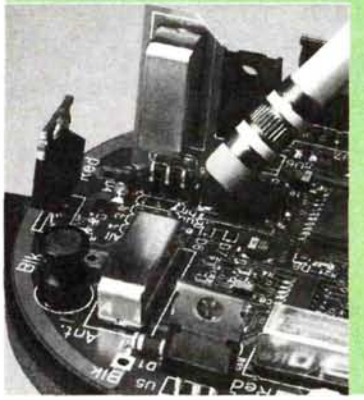


AREA FIFTY-ONE TECHNOLOGIES ROSWELL

Area Fifty-One* manufactures this outer-space R/C vehicle. Most of the Roswell's assembly is straightforward use of foamboard to support the electronics and outriggers. Pay attention when you align the motors, and keep glue out of the bearings! The instructions are great. The receiver setup and the explanation of how to tell if your servos need to be reversed are very well written. You don't have to spend too much time at the workbench before you test your alien wings!

• FLYING THE ROSWELL

Picture your own personal UFO! This model is a riot after you've trained your thumbs. Like the instructions say, heli experience will help. Another consideration is that this model would make a great heli trainer! Most heli students are impeded by having to learn so many functions at once. In hover, the Roswell does not drift in yaw like a heli does, so work load (brain load) is minimum. Another plus is that it has the best duration of the three models discussed here, but then again, it is the most expensive.



The concept of the Roswell is really cool, and a lot of mixing takes place in this machine's electronics. Forward motion is accomplished by increasing the power to the rear rotor while simultaneously reducing the forward rotor by the same amount. The net result is no loss of lift, just a redistribution of thrust. Aft, left and right motion work the same way.

Yaw command is probably the coolest yet. For instance, a left rotation in yaw is accomplished by accelerating the two clockwise-turning rotors while decelerating the counterclockwise-turning rotors. Because like-turning rotors are opposite each other, you get pure yaw motion with no unwanted pitch and roll!

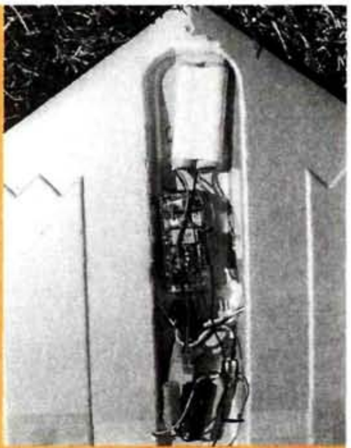
Everything is kept in check by the three piezo gyros (one for each axis). The gyros sense change and correct it long before your reflexes begin to react. The piezo gyros will always try to keep the Roswell at the same attitude where you last positioned it. Don't expect them to be an autopilot; they are accurately termed "stability augmentation systems."

• WHAT'S NEXT?

This model makes my imagination go wild. I would love to see the manufacturer slave an acceleration piezo or an IR distance measuring device (aiming straight down) into the throttle/collective axis. You could trim the Roswell so that the center stick position of your throttle joystick would be the dedicated hover point. Then you would need to put centering springs into your throttle stick like the rest of the channels have. The Roswell would maintain altitude every time you let go of the stick! You could even add in an autopilot; the possibilities are endless!

I wish my IFO were stronger. Since I built it, Area Fifty-One has hinted that—among other top-secret Roswell experiments—ongoing research and development have included the use of stronger material for the airframe. I guess I'll have to wait for the information to be declassified ....

WATTAGE B2 POCKET STEALTH BOMBER



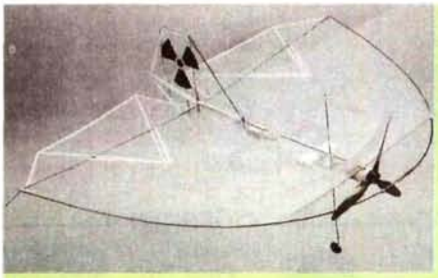
This little delta-wing is available from Global Hobby Distributors*. The B2 is constructed of molded foam and is molded in two halves and then joined at the leading and trailing edges. This is done to save weight, and although foam doesn't weigh much, keep in mind the percentage of frame weight that is saved by this step: flight duration is measured in grams when you can replace useless structure weight with enlarged battery capacity. Assembly of the B2 is limited to attaching the wingtips and mounting the airborne components. Of note is the system used to mix the motion of the inboard and outboard panels of the elevons. The designers use a thin strip of acetate, about 3/16x1 1/2 inches. This is curved into a U, and each end is inserted into the trailing edge of the inboard and outboard elevons where they are closest. This system works incredibly well and has virtually no slop if the hinges are free. You need to use care when you epoxy the ends into the control surfaces, as it is very easy to misalign the surfaces. The elevons should be very carefully viewed from the trailing edge to make sure they are parallel to the area of the joint.

• FLYING THE B2

I would estimate that the B2 starts flying at 5 or 6mph and has a speed range of 5 to 20mph. This is pretty neat when you think of the weight of the model. The B2 is easily destabilized by turbulence so, if there is any wind at all, use caution when flying near obstacles. My B2 nearly met its doom one morning when I was flying next to my home with a wind of less than 3mph. As the wind blew over and around the house and hedges, it created updrafts and downdrafts that kept the B2 at the ragged edge of control. If there's any wind at all and you want to fly outside, you're better off in a large field. Otherwise, on calm days, the B2 can be flown even in a small backyard. It's extremely agile and can do some terrific aerobatics. With lighter, lower mAh batteries, the B2 was also a blast to fly indoors in a nearby gym.

The first time I hand-launched the B2, it nearly did a loop and ended up behind me. I realized that I had failed to consider that I was throwing it, instead of launching it. Remember, it only weighs 5 ounces! Think about how you launch a paper airplane or throw a dart: you use your wrist much more than your arm. I recommend trim-tossing models like the B2 into heavy grass a few times without power. You will be able to get the trims set pretty closely before applying power.

This plane looks cool but, like many other foam models, it can become dinged easily, so handle it carefully. I did find a gray adhesive-backed vinyl at a sign shop that perfectly matched the color of the paint. This proved great for taping over the servo holes and covering the slots you need to make to install wires. I also used it to make a handy hinge for the rear of the canopy. It now opens like a car hood. I used a little patch of Velcro®-brand fastener to anchor it at the front.



DAN KREIGH IFO FLYING WING

I really enjoyed building the Dan Kreigh IFO (available from Hobby Lobby Intl.*). It is radically different from my normal building technique, but all aspects make perfect sense after you get things laid out. The carbon rod needs to be bound at every joint. Use great care in how you use the Kevlar thread in binding, as there is not much left over, even if you are as frugal as Scrooge with it!

The real treat comes in covering the model. The provided material is lighter than dry-cleaning bag material but fortunately is much stronger! You use 3M 77 adhesive spray to attach it to the structure, and you must align it very carefully before contact. I tried a few test panels to establish the time window I had to align and anchor the material to the carbon rod. I recommend this to all builders. This material does not stretch much, so make sure your elevons are deflected down to the maximum down-throw that you will need before you affix the covering (I used 45 degrees).

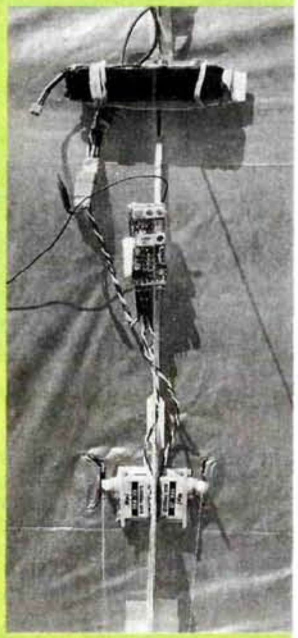
Don't scrimp on how you anchor your servos. If they come loose, you will crash! Don't be squeamish about gluing them in and cutting off their traditional mounting taps; save every gram for batteries! Also, resist the temptation to put in a connector between the speed control and the motor. I strongly urge you to solder them for the sake of weight and on the off chance that you may some day connect the battery to the wrong side of the controller and fry it.

A new version of the IFO, the IFO Mark 2, became available just as I wrote this article. A few of the improvements include a new motor system for better thrust-to-weight ratio; an all-carbon fuselage; nylon tube "hinges" that you slide over the carbon trailing edge; the elimination of wing Kevlar guy wires except for gear support; "aero-balanced" elevons for less servo strain; and detachable vertical tail and landing gear for easier transport. The manufacturer notes that the Mark 2 should require 40 percent less building time.

• LET'S GO FLY

If the IFO is moving, it is flying. It has a speed range of 0 to 10mph; beware the 10mph red line! This is the wall where aerodynamic forces will overwhelm your servos. I recommend that you select servos with at least 20 ounces of torque. If you overpower the servos, nothing will save you if the nose is down! The model will continue to accelerate, and all hope of a recovery is nearly futile. If you have the time, chop the throttle; this will allow more current to be available to the servos and maybe save the gearbox and speed control from damage. Without the engine drawing power, you may have the critical milliamps you need to unstall the servos. Before I changed to more powerful servos, my IFO went straight into the ground on more than one occasion.

The IFO is a treat to fly at slow speeds. As you go behind the power curve, all you need is ample power to balance the forces of gravity with thrust (instead of lift). This phenomenon can catch you off guard. Remember that only the engine thrust or inertia can make you climb. The purpose of the elevons is merely to establish angle of attack. Once you transition to "hover," the elevator will become fore and aft control. You don't have rudder control, so don't bend the stick when nothing happens! Actually, the aileron portion of elevons changes to yaw input as you transition to hover.



The best way to hover your IFO is against a light breeze—anything approaching 2mph will do. The model hovers flawlessly at about a 45-degree angle. At this attitude, the necessary yaw stability is provided by the weathervane principle, and your ailerons give you ample clout in yaw.

This plane is the most rugged of the bunch; with its front carbon propeller guard, this model is perfect for "rough and tough" flying, which might include front yard neighborhood aerobatics, streamer combat or even pylon racing around ribbons supported by helium balloons from a local flower shop.

NEW MATERIALS, CONTROL SYSTEMS AND RADIOS

The first wonderful expansion was in the use of non-traditional building. The balsa tree still has a wonderful future in R/C, but think of how much lighter and better we build our models now using Kevlar, carbon fiber, fiberglass, molded foams, plastics and more! We used to build for strength and would add weight to achieve it. Fortunately, we learned from our mistakes, i.e., how to incorporate the new materials into old designs. But more importantly, the new materials changed the way we design model aircraft. We now build as light as possible to enjoy longer, safer and much more realistic flying models.

The second revolution to arrive in our midst is the miniaturization of most control components. Probably the most important progress has been made in the miniaturization of our airborne components. What's amazing is that the price has stayed reasonable. We now enjoy miniature receivers, servo and speed controls. Heavy gyroscopes that used to consume so much power have now been replaced with piezo gyros, which have no moving parts and use barely any current. It is now as natural to find a piezo gyro in a plane as it is in a helicopter!

The third revolution rides on the heels of our computer generation. Think of the progress in computer radios: multiple model memories allow us to bring eight or more different models—but only one transmitter—to the field. Programmable radios allow mixing and slaving of channels in ways that used to require outrageous bell-cranks, mounting hardware and bearings.

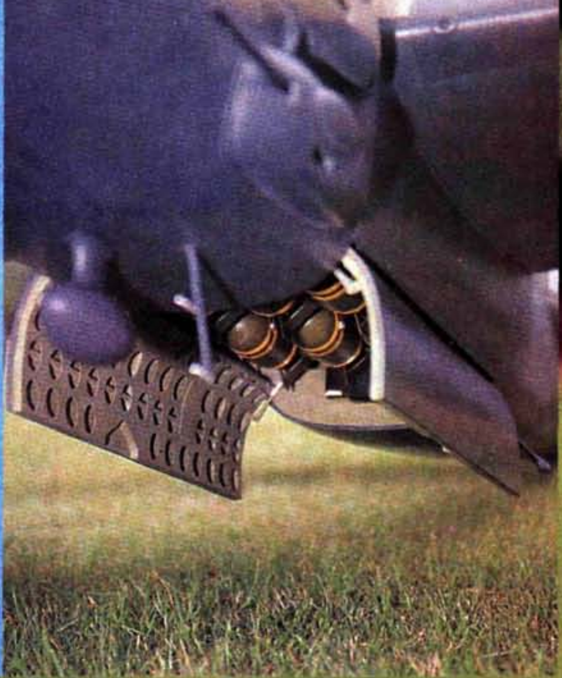
FLYING UNCONVENTIONAL MINIATURE MODELS

The best advice I can give is to consider the weight and speed range of your model before you fly. These models will not groove like pattern ships and will fail if flown too fast. The speeds that are realized for safe indoor flight should be the benchmarks for safe outdoor flying.

All of these planes climb well. But you need to bear in mind that drag plays cruel games on a model that weighs only 5 ounces! If you haul the nose up (a high angle of attack is a tremendous amount of induced drag), the model has no inertia and relies on its thrust to keep it heading in that direction. There is almost no stored energy in these models. The flip side of this is that they bounce when they crash. It is the logic of the ant falling off the table and falling to the floor and then continuing on its way as if nothing ever happened. It has virtually no weight, therefore no inertia, so it never impacts with enough velocity to inflict damage.

These unconventional micro machines put to best use the newest R/C flying ideas: computer-radio flexibility, non-traditional materials and miniature components. I can't wait to see what's next!

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*



by Debra Sharp

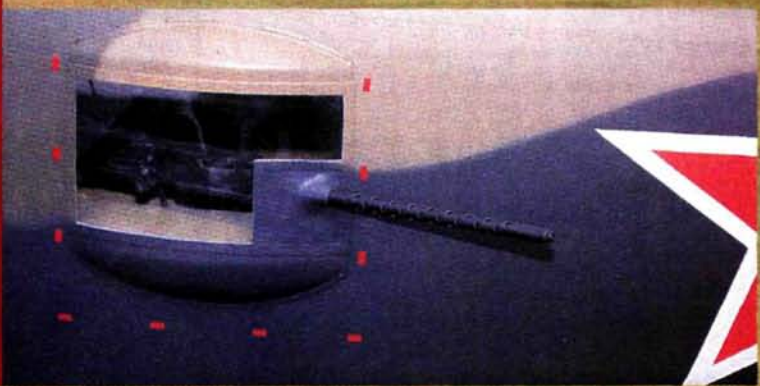
Readers' Gallery

B-25

John Tozser spent more than two years—that's 3,000 hours!—building and detailing this B-25 model. It earned the highest static score at this year's Top Gun—an outstanding 99.083 points. Bill Fuori flew the model in Team, in which it finished in sixth place.

John built the plane using enlarged Ziroli plans and equipped it with two standard G-38s, Robart retracts and Glennis tires, brakes and rims. A Futaba 1024 radio with two receivers and 16 servos provides control. The B-25 features a full cockpit interior, functional navigation and landing lights, a bomb drop and flaps, and it weighs about 52 pounds ready to fly with bombs and fuel.

It's finished with fiberglass, Z-poxy and resin and automotive lacquer. John copied a color scheme that was used on about 500 lend/lease airplanes that were painted in the U.S. and sent to Russia, and he notes that in the Smithsonian's records, the serial number of the particular plane he modeled is that of a Piper Cub. "Just goes to show the accuracy of records," he laughs. Pilot *Bill Fuori* says that the model has taken to the skies more than 25 times, and it flies great.



SPECS

Model: B-25 Mitchell
Scale: ⅛
Plans: Ziroli +21%
Wingspan: 121 in.
Weight: 52 lb.
Engines: G-38
Prop: Bolly 18x10

DÉJÀ VU! Think you've seen this Tequila Sunrise model before? In the January '99 issue of *Model Airplane News*, I had the pleasure of reviewing the Global* .25-size Tequila Sunrise. I could make this the shortest review in *Model Airplane News* history just by telling you to re-read that review, as the .40-size Tequila is just as nice as the .25-size one, only it's a bit bigger! But so you don't have to dig through your back issues, and to help out any new readers, I will approach this as if it were any other kit review.

Upon opening the box, I did a double-take. This kit must have one of the lowest parts counts of any ARF I have built. While checking for the non-missing pieces, I scoped out the quality. What can I say? High-quality subassemblies, good documentation; the only way it gets better is to have someone deliver it to you ready to fly. Of course, then you would miss out on building this excellent kit.

Because of the high quality and documentation of this ARF, I won't rewrite the manual in this review. I will mention the construction steps in sequence then tell you what I did that might make your workbench time a tad easier.

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

by Craig Trachten

GLOBAL QUALITY KITS

.40 TEQUILA SUNRISE

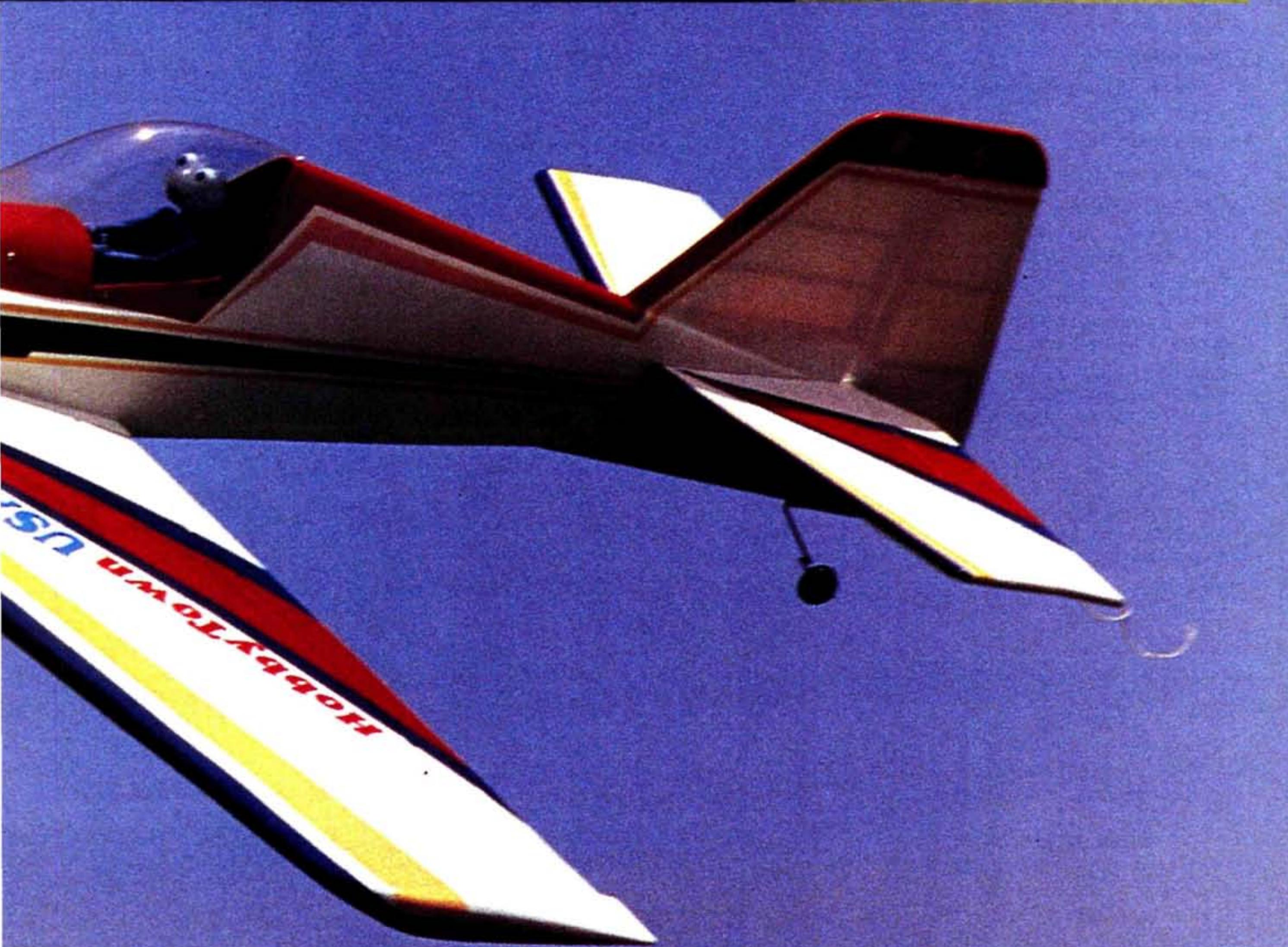
South-of-the-border barnstormer

WING, GEAR AND EMPENNAGE ASSEMBLY

Start by installing the ailerons. Whenever I use CA hinges, the thin CA tends to run down the wing—even when I use a fine-tip bottle! I've found that by using Bob Smith* pipettes, which have very fine tips, CA control is no longer a problem. A few drops on the top and bottom of each hinge, repeated twice, will do the trick. Joining the wing halves can also be a messy gluing step. Try wrapping masking tape around each wing-root half before applying the epoxy. You can easily wipe any ooze off the tape, and after you've removed the tape, you will have a clean, epoxy-free surface.

The aileron servo is installed the same way as it is in just about every other aircraft that has a single, center-mounted servo. The only change I made was when I secured the pushrod to the servo arm: I used an L-bend and snap-on pushrod keeper because I dislike Z-bends. (After all these years, I still can't get them as tight as I would like.)

Securing the wing to the fuselage starts with installing the wing screw plate. Here is where I employ my favorite adhesive, Zap* Gel. This gel has the viscosity of toothpaste, so it stays where you put it. I use it whenever 5-minute epoxy is called for. Zap CA does not have to be mixed, and it sets up faster. I also used this gel to hold the



blind nuts in place. To finish the wing assembly, you only have to attach the belly pan. Once again, I deviated from the prescribed adhesive. When I attach plastic parts, I use an aliphatic glue like Pacer* Formula 560. The adhesive can be applied liberally for a good bond, and the ooze can be wiped away with a damp paper towel.

Installing the horizontal and vertical stabilizer is simple and straightforward. I don't have any tricks, shortcuts, or helpful hints; just follow the instructions. I will say that it has been a long time since I came across an ARF in which the stabilizers fit square and plumb without some sanding and finessing, but all the pieces and parts of the Tequila fit without any help from me! CA the elevator to the horizontal stab, epoxy the tailwheel bearing to the rear of the fuselage, CA the rudder to the vertical stabilizer, and you've finished with this section.

Simply drill two holes and mount the landing gear with two 5x10mm machine screws; that's it! The wheel pants will really give your aircraft a finished look.

ENGINE INSTALLATION

New step, same advice: just follow the instructions. An alternative for your consideration is to use machine screws with locknuts instead of the provided sheet-metal screws. I prefer them not only for the easier installation, but also because I don't have to worry about stripping the threads or—even worse—breaking the sheet-metal screw in the mount. I used a Magnum* XL series .46AII to power the Tequila .40. It is a good idea to break in your engine before you mount it on the

SPECIFICATIONS

Manufacturer: Global Quality Kits

Model name: Tequila Sunrise .40

Type: low-wing sport ARF

Length: 47.25 in.

Wingspan: 52 in.

Wing area: 570 sq.in.

Weight: 5 lb., 10 oz.

Wing loading: 22.74 oz./sq. ft.

Engine req'd: .45 to .53 2-stroke or .52 to .60 4-stroke

Engine used: Magnum .46AII 2-stroke

Prop used: 11x6

Radio req'd: 4-channel (throttle, rudder, aileron, elevator)

Radio used: Futaba 8UAP

Fuel: Omega 15 percent

List price: $169.99

Features: built-up construction; a one-piece, sheeted, D-tube wing with capstrips; painted fiberglass cowl and painted molded polystyrene wheel pants; covered with polyester film; accepts standard radio gear.

Comments: the .40 Tequila Sunrise is *an attractive ARF that's easy to build.* At the field, sport and pattern fliers will have a ball.

Hits
- Low parts count.
- Excellent materials and construction.
- Fast and easy to assemble.
- Very good instruction manual.

Misses
- None.

aircraft. My American Hobby Products* TS1 is the best fully adjustable stand I have been able to find.

Fuel tank and servo installation is straightforward. I used Futaba* 3003 servos and a standard Futaba receiver.

COWL AND CANOPY

Here are a few tips that will help you with this and any other cowl you have to install. I tape strips of index cards to the fuselage behind the cowl mounting position. They should cover the part of the engine where an opening has to be cut in the cowl: head, needle valve, low-speed needle screw, muffler. When all the marks have been made, flip back the card stock and remove the head, needle valve and muffler. I stuff a little piece of plastic wrap in the needle-valve opening to keep dirt out. Attach the cowl to the fuselage, and flip the card stock back over the cowl. Drill a small, ⅛-inch-diameter hole at each mark on the cards. Shine a flashlight through these holes, and make sure that the light beam hits the center of each opening. Note any minor adjustments

FLIGHT PERFORMANCE

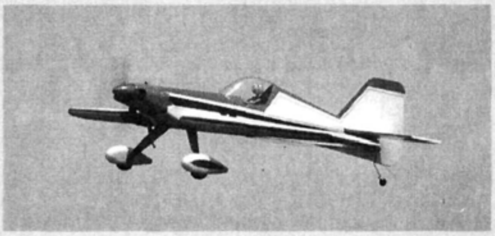
After a week of trying to get the wind and the sun to agree, we gathered as guests of the gracious Westchester Radio Aero Modelers (as in WRAM Show). Their putting-green-short field is immaculate and a perfect place to test-hop a new project—thanks, gang!

• TAKEOFF AND LANDING

The requisite range check was completed and the Magnum engine fired right up. After one last check of the control-surface deflection and direction, I taxied out. The Tequila Sunrise tracks smoothly. Even in a crosswind taxi, the model resists weathervaning and goes where you point it.

The long fuselage and tail provide longitudinal tracking, and the plane needed only a little rudder to keep on a straight run. As I accelerated to about ¾ throttle, I let the Sunrise lift off on its own. With a few beeps (computer radio) of right aileron, the plane felt comfortable immediately.

I performed a few mock landings at altitude and enjoyed the predictability with which the plane slowed down. As a matter of fact, it was during one of these fake touch-downs that I chose to roll out and set up for a real approach. Performing a wide arc, the Tequila Sunrise "slid down the banister" into one of those landings where you hope someone is watching.



• LOW-SPEED FLIGHT

The Tequila Sunrise gives you the perception that it has a very narrow wingspan. In flight, nothing could be further from the truth. Actually, the plane's handling is almost "pattern-like." The large control surfaces offer plenty of control right through deceleration and landing transition, without the tendency to become mushy.

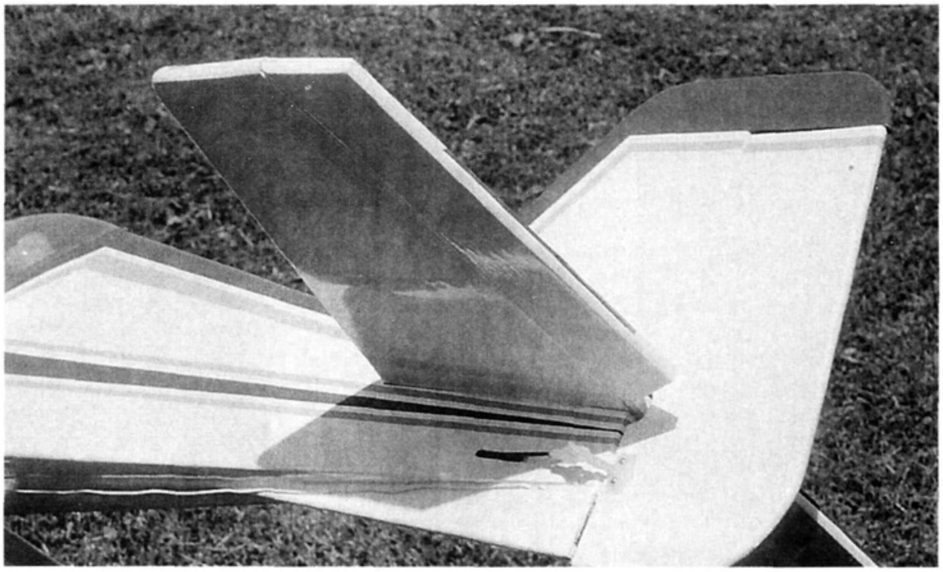
• HIGH-SPEED FLIGHT

I spooled up the Magnum to full throttle. The engine and plane are perfect mates for each other. During testing there was no tendency to flutter, and the faster the plane went, the better it grooved. There's a smoothness to the reaction of control input that gives the Tequila Sunrise a silky feel at the transmitter.

• AEROBATICS

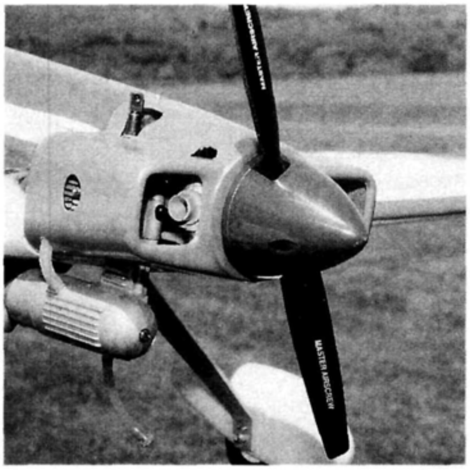
The first item is what I call "wing check": a 45-degree vertical entry with a left inside snap command. This is followed within ½ second with full down-elevator and creates a ridiculous uncontrolled tumble that will give you a good indication of how limber a plane is (and how good your epoxy joints are). The Tequila Sunrise practically ties itself in knots. Roll rates are approximately 450 degrees per second, and the airplane sustains inverted flight hands off.

The Tequila's vertical and horizontal stabilizers fit perfectly without any help from me!

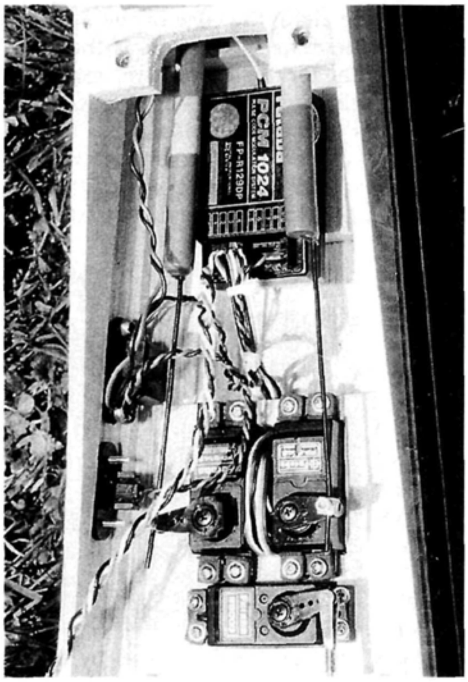


necessary. Remove the cowl, then go to town with your motor tool. Check the size of the openings often; it's easier to take a little more off than to put some back! When all cuts are finished, I spray the cylinder with motor cleaner to get rid of any dirt, then reattach the head, needle valve and muffler. Before I attach the cowl to the fuselage, I CA pieces of CA hinges to the areas where the mounting screws pass through the cowl. This helps to prevent stress cracks from forming around the mounting holes.

Cut out the canopy along the molded cut line. A good pair of Lexan scissors will make this job easier. The instructions tell you to secure the canopy with four small screws, then finish the canopy off with trim tape. Follow these instructions, but read them in a mirror. It is tough to apply trim tape over screw heads; I tape the canopy in place then attach the screws. A touch of black paint on the head of each screw will make them almost disappear.

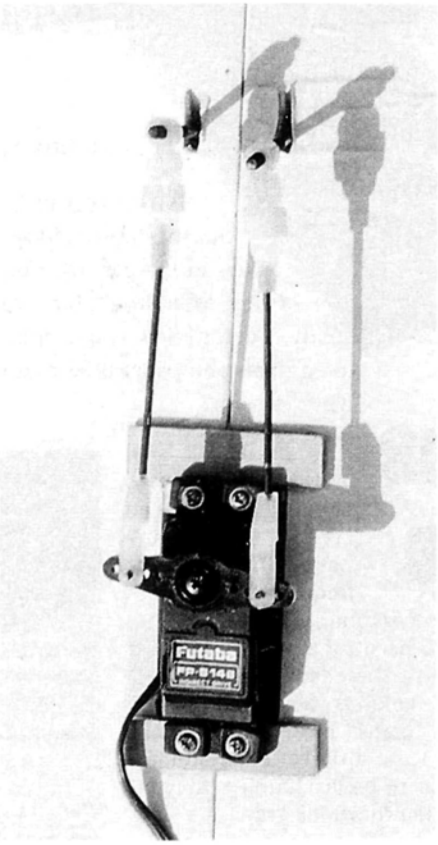


The Magnum XL series .46AII engine I used to power the model fits nicely inside the molded cowl.



The .40 Tequila Sunrise has more than enough room in its fuselage for the standard Futaba servos I used for throttle, rudder and elevator.

I used an L-bend and snap-on pushrod keeper on the aileron servo, which is installed the same way as it is in just about every other aircraft that has a single, center-mounted servo.



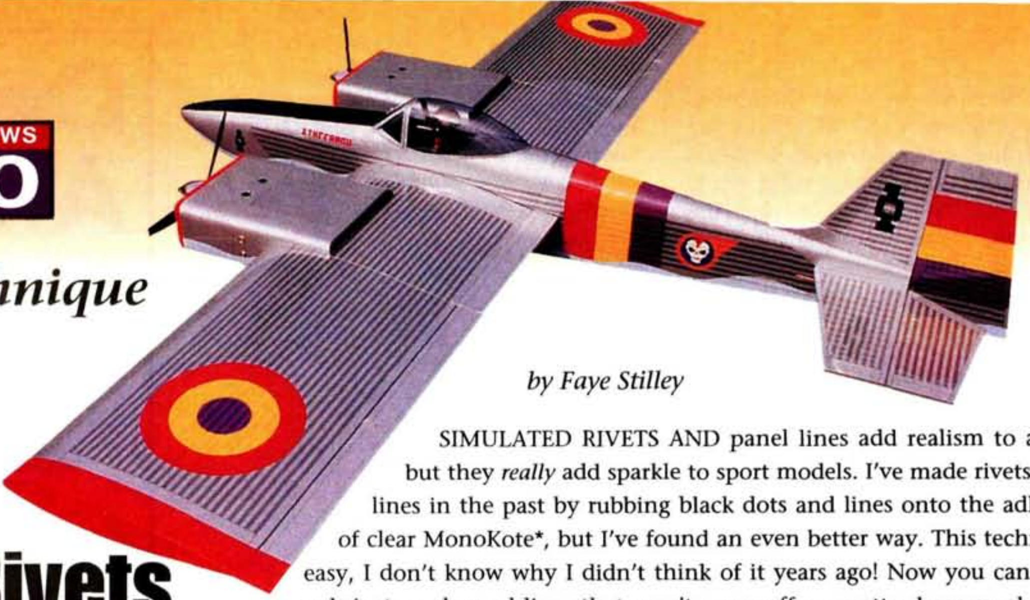
I won't discuss how to balance your aircraft because many factors come into play. Which engine did you use? Is your receiver pack square or flat? The only thing I can tell you is that the proper balance is critical. If you err at all, make sure it is on the nose-heavy side. If the model is the least bit tail-heavy, you're inviting misfortune.

BUILDER'S RECOMMENDATION

If you like 'em fast, sleek and snappy, this aircraft is for you. The Tequila Sunrise is not for slow thumbs or the weak of heart, although most intermediate fliers will be comfortable at the sticks. The .40-size Sunrise is a well-built, attractive ARF airplane that has an extremely low parts count, so it's easy to assemble and will get you to the field in a hurry. What more could you ask for?

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

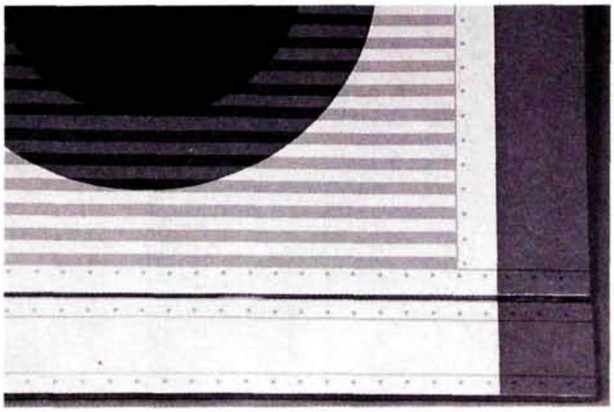
An easy technique to dress up your model



Create Rivets and Panel Lines with MonoKote

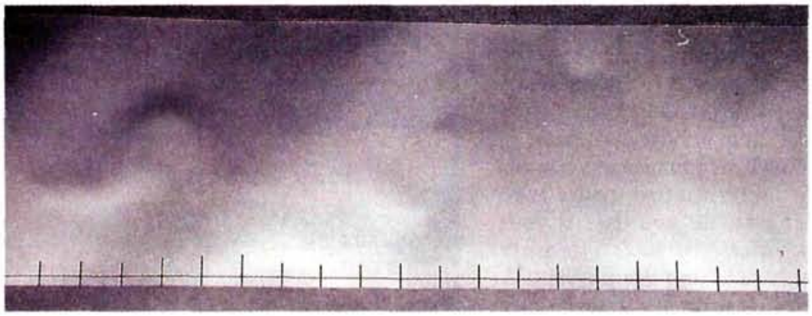
by Faye Stilley

SIMULATED RIVETS AND panel lines add realism to all models, but they *really* add sparkle to sport models. I've made rivets and panel lines in the past by rubbing black dots and lines onto the adhesive side of clear MonoKote*, but I've found an even better way. This technique is so easy, I don't know why I didn't think of it years ago! Now you can make colored rivets and panel lines that won't come off no matter how much you clean your airplane.



1

This wing has two types of simulated rivets: one with a panel line alongside and another without the panel line. When the rivets follow a color separation, as they do on the trailing edge of the wing, there is no need for a panel line. The panel separation is obvious because of the change of color. When the simulated panels are the same color as they are on the aileron, a panel line shows where one "panel" meets the other. To give definition to the rivets and panel lines, I use a darker shade for the panel color. Rivets and panel lines rarely appear to be black unless they are on an airplane that's painted black, and even then they look gray.



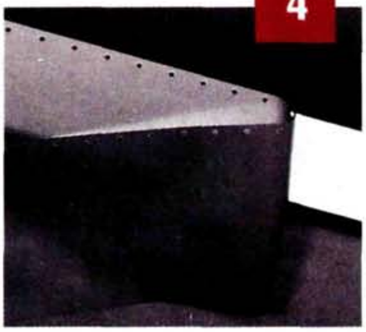
2

To make rivets, first lay out the desired spacing. Begin by cutting the MonoKote, using a straightedge to get a clean cut. Draw a reference line along the edge of the material with a fine-line marker. This line is the horizontal centerline for the rivets. In the example, the line is 1/8 inch from the edge. Then measure and mark the vertical centerlines. I spaced these 1/2 inch center to center. The "crosshairs" will be used as targets for the "rivet cutter" in the next step. These measurements will differ with individual taste and the size of the airplane.

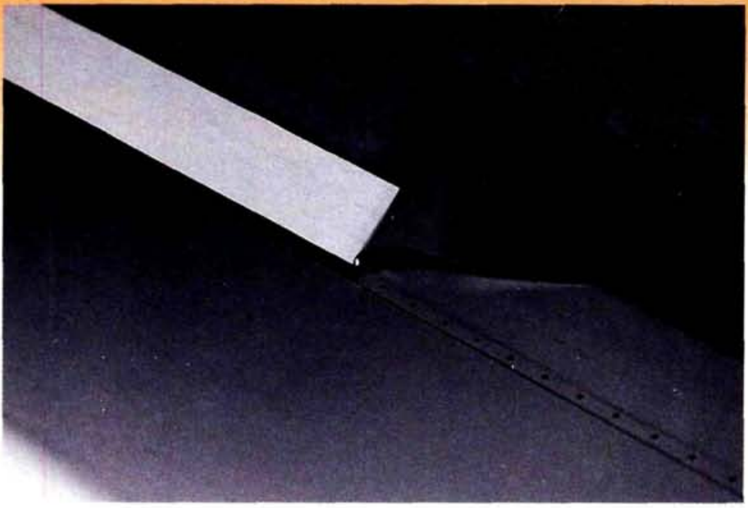
3

This $12 tool from Synthesis* cuts six sizes of holes from 3/32- to 3/16-inch diameter. The 3/32-inch-diameter hole would simulate a 3/8-inch rivet head on a 1/4-scale airplane, or about a 7/16-inch rivet head on a 1/5-scale airplane. Center the cutting tube over the crosshairs and squeeze the handle. That's it; move on to the next target and continue right down the line! I found that I made very clean holes by putting a piece of poster board between the covering material and the anvil of the tool. Heavy paper like Bristol plate works equally well. After you've made all the holes, clean off the reference lines with alcohol.

4



I've partially ironed down a panel with the rivet holes over a panel of a different color. This row of rivets will not have a panel line alongside. The panel with rivet holes overlaps the first panel by about 3/16 inch, allowing the color of the first panel to show through the holes. After the MonoKote has been ironed down, the seam is fuelproof and the rivets are permanent.

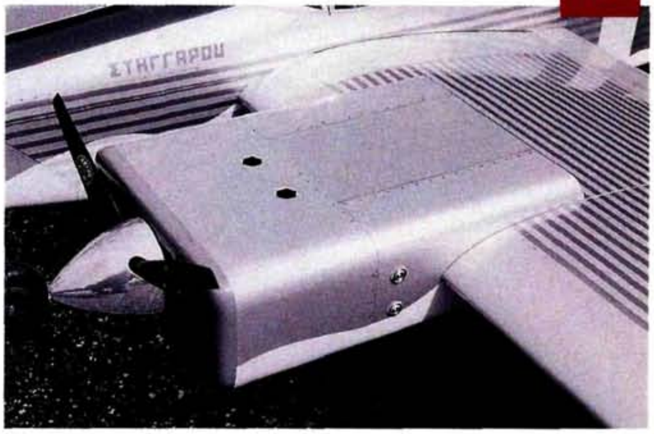


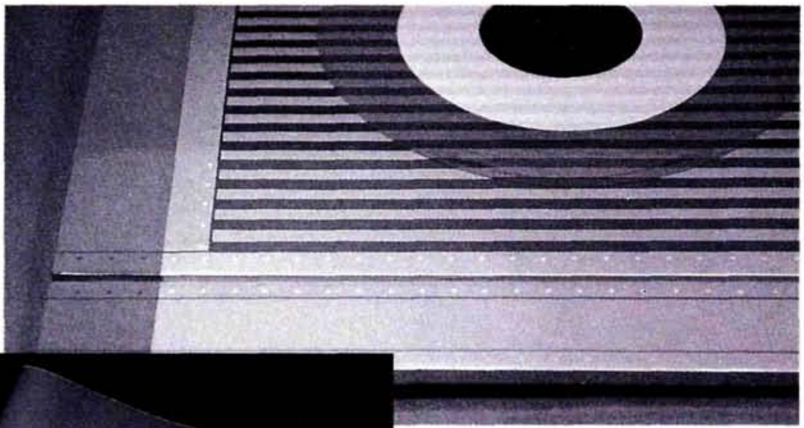
For rivets with panel lines, the procedure is slightly different because you need to add a color for the rivets and panel lines. I cut a darker, ¼-inch stripe and ironed it onto the first panel, overlapping it by about 3⁄32 inch. When the second panel is ironed on, the panel line is created by leaving a 1⁄16 inch or less gap of the darker stripe showing between the panel edges. The second panel creates the fuelproof seal. You can make a double row of rivets by cutting the darker stripe about ½ inch wide and ironing it on first. Prepare both panels with rivet holes and apply them with a gap between them to simulate the panel line.

5

When you have a real panel line (the line formed when two parts meet), only the rivets need to be created. In this example, the panel line is created where the cowl meets the nacelle. The underlying color stripe is applied to the cowl, and the covering material for the cowl is prepared with the rivet holes about ¾ inch in from the edge of the MonoKote. This allows enough material to wrap around and seal the edge of the cowl.

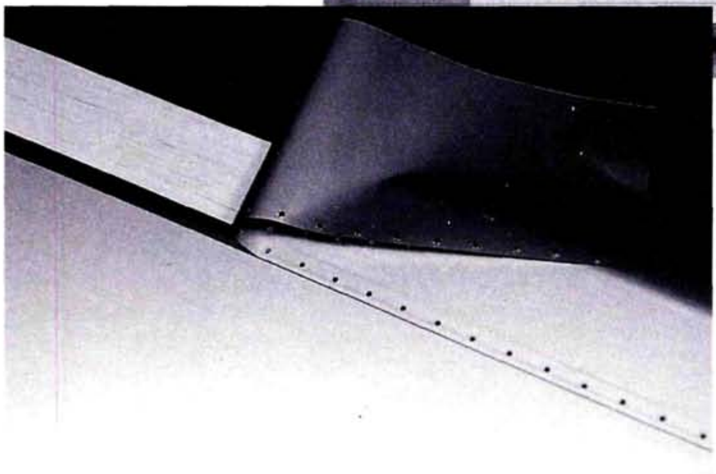
6





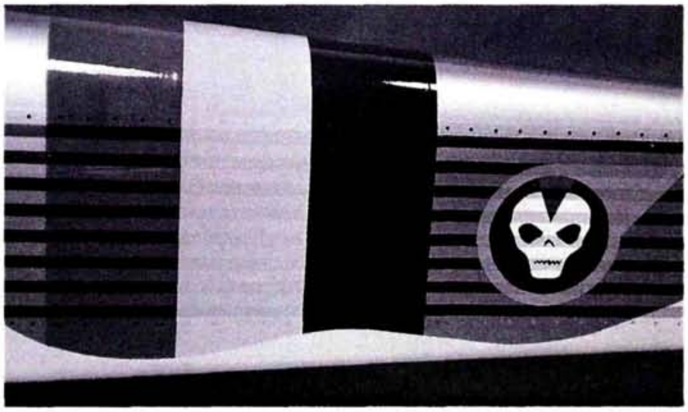
I said earlier that rivets add sparkle to an airplane. These rivets really add sparkle because they are chrome. They are like little lights turning on and off as the plane flies by. In this example, I used Aluminum MonoKote for the panels, Platinum MonoKote for the panel lines and Chrome MonoKote for the rivets.

7



8

The technique already discussed is used to apply chrome rivets, except two color stripes are used instead of one. The first, a 3⁄32-inch stripe of the darker color (Platinum), is applied on top of and flush with the edge of the first panel (Aluminum). Then a 3⁄16-inch stripe of Chrome is ironed on, butted against the edge of the first panel. The Chrome MonoKote appears black in the photo. When the second panel with rivet holes is ironed on, the gap between the panels allows the darker color to show through, simulating the panel line. The underlying Chrome stripe shows through the holes and simulates a row of shiny metal rivets.



9

Rivets and panel lines appear much more realistic when they are a shade darker than the panel. Although this photo is black and white, you can see that the rivets and panel lines are not black. The three vertical stripes are actually red, yellow and purple on an aluminum airplane. I used a darker red, yellow and purple for the rivets and panel lines in each of the stripes and chrome rivets on the aluminum fuselage.

*Addresses are listed alphabetically in the Index of Manufacturers on page 134.

MODEL AIRPLANE NEWS

CONSTRUCTION

PHOTOS BY STAN RUTZ

Build a .20-size forgotten fighter

Arado 76

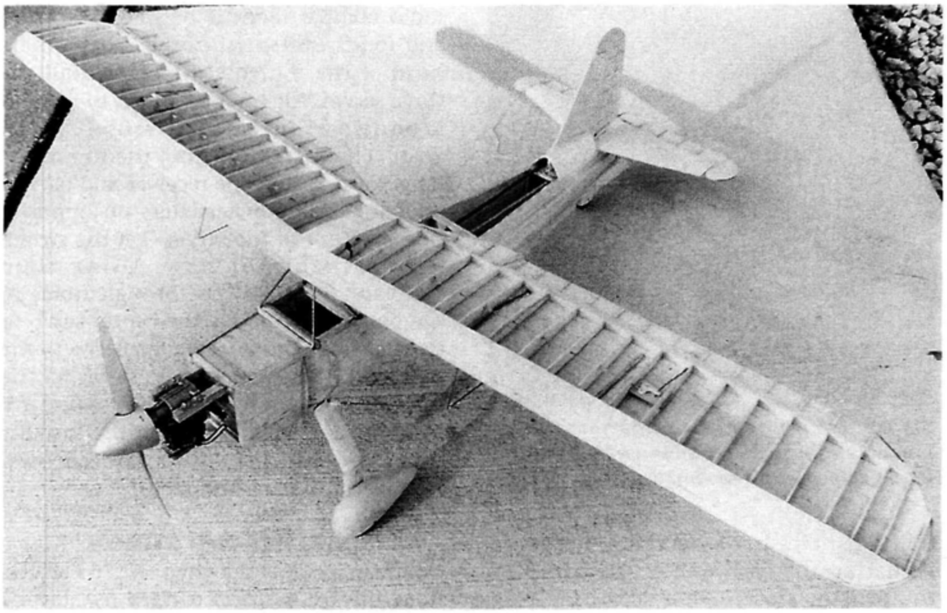
by Stan Rutz

THE SEPTEMBER 1938 ISSUE of *Model Airplane News* contained plans for a 20-inch-span, rubber-powered Arado 76: "... a new German fighter/trainer." I built it, and when .049 glow engines emerged a decade later, I turned it into a Wasp-powered U-control and flew it indoors. It was a crowd pleaser—especially when it landed, and I was too dizzy to crawl to it! Because it was a natural for R/C scale, the Arado remained high on my "planes to build again" list. More years passed before I came across a set of 3-views that agreed with my collected photos. Those drawings inspired this small, inexpensive, sheet-balsa R/C version built around a 4-stroke O.S.* .20 and Sig* Smith Mini wheel pants. The R/C Arado is gorgeous and flies even better than the previous versions. On its first flight, it took off from grass and flew 24 low passes for the photographer, with all trims centered. Now it's a year old and still unscratched.

WING CONSTRUCTION

Select five, 1/16x3x28-inch balsa sheets. Split one down the center and make two, 7 1/2-inch sheets (hold them together on a flat surface and apply thin CA along the seam). Trace the wing halves, excluding leading edges (LEs) but including ailerons and rib spacing. Cut them out, crack them at the outermost full rib line, raise the tips 1/2 inch and CA the crack. Install the rear spars (tapered up to 1/8 inch beyond the crack). With a 1 5/8-inch block under the crack at one tip (4 degrees dihedral), CA the halves together; then add the LEs. CA 1/8x10-inch basket reed (or laminated balsa) to the ends of the wing.

Using a light aluminum pattern, cut out the balsa ribs and CA them into place. Add the LE capstrips and aileron spars and sand them to shape. Add the aileron ribs, cut the ailerons free and bevel the front bottom edge for down-throw.



Top view of sheet balsa substructure.

SPECIFICATIONS

Model: Arado 76—a German defense fighter and aerobatic trainer (1934 to 1944)

Type: sport-scale

Wingspan: 50 in.

Length: 37.5 in.

Weight: 3 lb.

Wing area: 372 sq. in.

Wing loading: 18.6 oz./sq. ft.

Airfoil: thinned Clark Y (flat bottom)

Radio: 4-channel with four miniservos and 270mAh pack

Engine: 4-stroke O.S. FS .20 or FS .26 Surpass

Comments: designed by Stan Rutz, this strong, sport-scale model of an overlooked WW II-era aircraft is candy for the eyes and offers easy-to-fly realism. Building time is cut by extensive use of sheet balsa to exploit the no-pin advantage of CA and by the use of Sig replacement parts intended for other models.

Hinge the top edge of the spar to the top of the wing spar with a strip of MonoKote* (or polyester chiffon). Fold the aileron back and join the spars with a second strip. CA the control horns (cut the base off) in blocks inside the aileron with their tips protruding from the bottom. Install the miniservo (on its side), pushrods and bellcranks through the ribs and bottom of the spar. Route the servo lead through the wing bottom behind the servo. Fire up the radio and adjust the installation. Remove the servo.

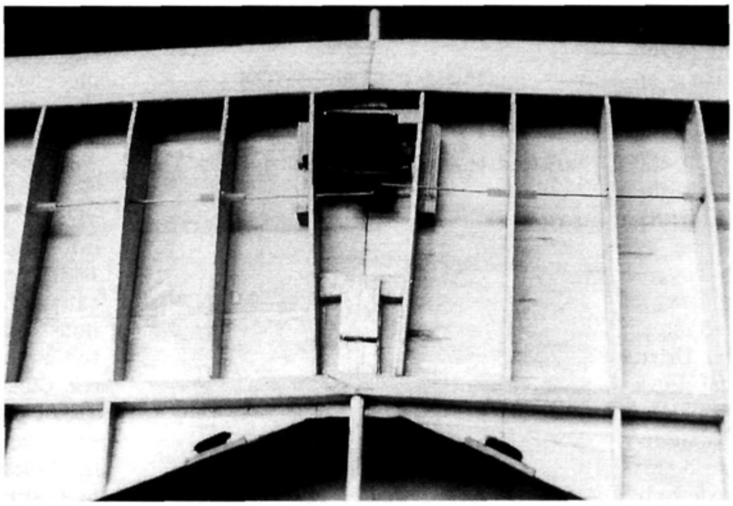
Drill 1/8-inch-diameter centerline (CL) holes in the LE and trailing edge (TE). Insert a waxed dowel through the holes. Build tight balsa boxes around its front and rear ends, and CA a stopper across the end of the boxes. Cut two, 1/16x1/4-inch slits for the cabanes through the box and the bottom of the wing at 1 and 5 1/4 inches from the LE. CA triangle-stock fairings below the 10th rib from the center. Flatten each end of two, 1/16x5 1/2-inch aluminum rods and use a 1/32-inch-diameter bit to drill them. Make 90-degree bends 1/2 inch from each end, and poke the rods through the wing and fairings, 1 1/4 and 5 3/4 inches from the LE to anchor the wing struts; liberally apply thick CA.

FUSELAGE ASSEMBLY

CA the longerons and stiffeners to the inside of each sheet-balsa side. Taper the tails and CA them together. Invert them on the plan top view and add the crosspieces. Add upper and lower side stringers and the sheet tail cap. Bolt the engine to the maple mounts with socket-head bolts and blind nuts. Center and CA these (with the engine inverted) to the bottom of the front and second top crosspieces (ends should be flush with the back of the second—no thrust offset). Add an extra crosspiece between the front stiffeners to support the motor mounts.

Build a bulkhead around the mount ends, tying them to the second crosspieces and stiffeners. Cradle the fuel tank in the bottom of the mount, with 1/2 inch of it protruding through a hole in the bulkhead. Build a bulkhead around its neck (gaps between this and the outer walls will be cooling tunnels). CA cowl formers to the outer walls 1 inch forward of the second stiffeners, and cut out the outer walls back to the stiffeners to form the tunnel outlet.

Bevel the front bulkhead, second stiffeners and stringer ends, and fit the inner tunnel walls. Sheet over the stringers between the gills and the third stiffener. Drill the front bulkhead for the throttle rod. Inlay sheet balsa, longeron to longeron, on the mounts and between the front and second crosspieces to form tunnel tops, and tie them to the bulkheads. Repeat in the bottom. Inlay sheeting flush with the longeron tops in the triangle behind the fifth crosspiece. Draw a fuselage CL on it.



Center section of the sheet balsa wing with servo and boxed cabane dowels. Note the scrap Gold-N-Rod pushrod bearings.

Cut a slotted hardwood block for the torsion-bar landing gear. CA two spruce strips to the block to form a tight center slot for the gear legs. Use two scrap wires to gauge the slot. Remove a section of the bottom longerons to allow the block to replace the second crosspiece. CA 1/4x1/2x1-inch hardwood blocks upright on the ends of the block and to the backs of the second stiffeners and outer walls. Use the scrap wires in the slot to position and drill the landing-gear holes through the slot into the upright blocks.

For wing-strut anchors, hammer and drill both ends of two aluminum rods to accept the strut clevises. CA one across notches in the bottom longerons at the rear of the slotted block, and the other 5 1/2 inches behind it. Add four equally spaced bottom stringers from slotted

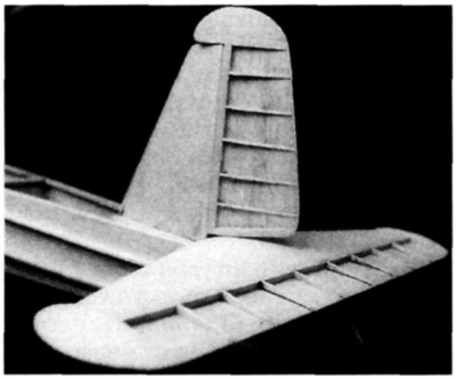
block to tail. Taper them at the tail to fit. CA 1/8x3/16-inch scrap between their front ends to form a bulkhead.

BUILDING THE TAIL

Trace the fin, rudder, stab and elevator on sheet balsa. CA the ribs, LEs, tips and spar to the top of the stab sheet. Sand them to the lifting cross-section on the plans, and sheet the top. CA the spar, sheet tips and ribs to the top of the elevator sheet and sand them.

Bevel the elevator's front bottom edge for down-travel, and join the elevator to the stab with a MonoKote hinge. Test the movement. Draw a CL on the top, perpendicular to the TE, line it up with the fuselage CL, and CA the stab to the longerons (note overhang). CA the elevator horn in a slot at the center of the elevator to hang in the middle of the gap between the tail cones.

Remove 3/16 inch of the front edges of the fin and rudder blanks. Make a duplicate of the fin blank, and CA both to the back of the fin's LE and to the sides of its spar. Taper with scrap to fill the top and bottom. CA the rudder sheet to the center of its spar and add long wedges to its sides. Sheet both sides of its top and bottom and sand the fin/rudder.

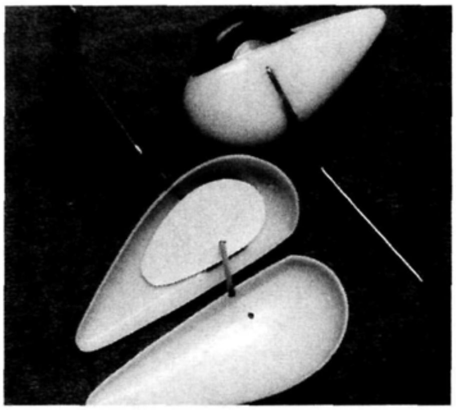


Completed sheet balsa tail assembly with strip hinges.

Bevel the right (starboard) front of the rudder to allow right travel. Hinge it to the fin with MonoKote. CA the fin to the CL of the triangle and the front of the stab, perpendicular to the stab. CA the rudder horn through an angled slot in the lower front corner of the rudder to protrude on the right side.

LANDING GEAR

The Ar.76 had faired, cantilevered, steel tube wheel legs, with the lower third welded into a knee to allow vertical shock travel. Oil-damped rubber rings took the shock. The panted tailwheel was a static-conducting whitewall. To start, bend two music-wire legs. Drill an 1/8-inch axle hole in the inner halves of Sig SH-563 wheel pants. On them, mark the leg angle from the plan, and Zona saw the slots for the legs. Cut two inner pads out of lite-ply,



Sig Smith Miniplane ABS pants with lite-ply inner pad and sawed alignment slot. The wheel served as an assembly jig.

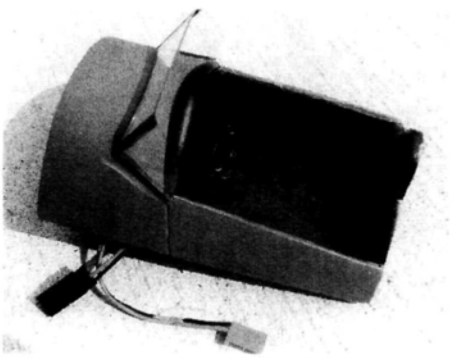
drill axle holes and bevel the pad edges to lie flat on the back wall of the pant. CA the pads in place. Use a wheel for a jig while using thick CA to glue the legs in the pant slots.

Mark and drill the axle hole in the outer halves. Trial-fit and add spacers on both sides of the wheel to allow it to turn without touching the paint. Align and CA the halves. Build up the bottom and rear of the pants with soft balsa and CA. Sand them to plan contours. Insert the legs in the slotted blocks. Secure them with gear straps near each end.

Bend the tailwheel strut out of piano wire. Build the tailwheel pant around the wheel from scrap balsa, rough-shaping the outside and leaving one side open while you smooth the inside. Allow 1/16 inch clearance all around. Sand and CA the inside surfaces. Groove the outside for the strut, and CA the strut to the pant. Add the wheel and spacers, cover the open side and finish the outside. Sandwich the strut's triangular top in three plies of 3/32-inch sheet balsa, and CA it to the inside of the lower longerons. The gear doesn't need to steer, but make it roll straight and free.

RADIO INSTALLATION

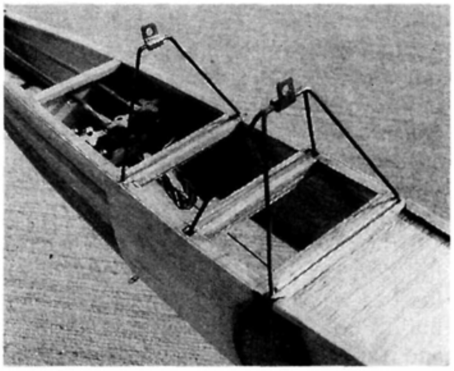
It's time for the radio. I used a 4-channel Futaba* but substituted a 270mAh pack and four Hobbico* CS31 miniservos. The radio compartment is between the third and fourth stiffeners. Install a balsa bulkhead at the fourth stiffener. Install the three servos side by side, 1 inch in front of it on two 1/4-inch-square rails 1 3/8 inch apart, 1 1/4 inch down from the top of the longerons. Mount the receiver and battery on hook-and-loop fasteners on opposite sides in front of the servos. Let the switch harness hang for now. Using rigid Sullivan* Gold-N-Rods through holes in the bulkhead, connect the center servo to the elevator horn and the left servo to the rudder. Connect the right servo to the throttle arm with light piano wire (use a V bend to tune its length). Test the installation, and adjust centers and throws. Remove the engine and radio.



Close-up detail of cockpit/radio hatch. Note crash pad, cockpit-door line, switch and headrest.

CABANES AND STRUTS

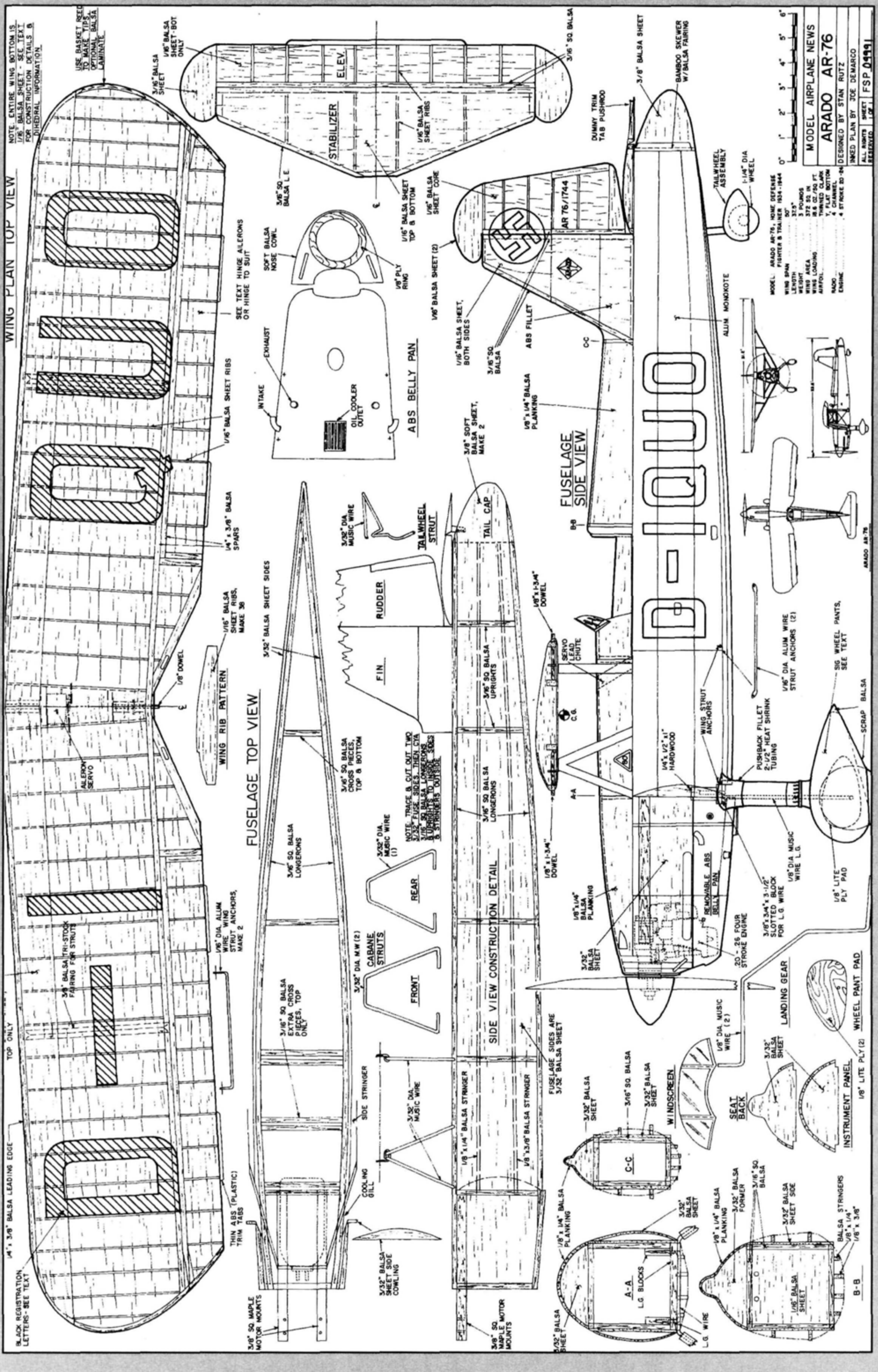
Contrary to some drawings, Ar.76 cabanes slant inward to form a rigid pyramid. I modified the similar Sig Skybolt setup to suit my model. It locks the parasol wing into place but allows quick removal. Bend the three triangular cabanes out of piano wire. Insert the ends of each cabane into a 3-inch length of 3/32-inch-i.d. plastic tubing. Notch the top longerons for the cabanes, one just behind the second crosspiece, another 2 3/8 inches behind it, and the rear just in front of the third crosspiece. Add four extra crosspieces to sandwich them, and liberally add thick CA.



The 3/32-inch-diameter wire cabanes are mounted in tubing between added cross-members. Note brass dowel fittings and wing-strut anchors.

Drill an 1/8-inch hole at each end of a 1/16x1/4x1 3/4-inch soft brass strip. Cut it into strips of 1 inch and 3/4 inch. Roll the 1-inch strip around the center of the front cabanes, forming a pyramid with the hole's center 3/16 inch above the wire. Roll the 3/4-inch strip around the flat of the rear cabane with the hole's center 3/16 inch above the wire. Silver-solder the brass to the wire. Run an 1/8-inch dowel through the holes. Line it up with the fuselage CL by heating and moving the rear strip.

Form the core of each side's pair of wing struts using a 28 1/2-inch piece of piano wire. Make right-angle bends 12 inches from the ends. Pass one end



FSP09991—TO ORDER THE FULL-SIZE PLAN, SEE PAGE 128 OR CALL (800) 537-5874.

through the holes in both anchors in the wing's strut-attachment fairings, working the first bend through the second hole. Silver-solder a threaded coupler to each end and attach two small plastic clevises. Attach the wing to the fuselage by putting the cabane's brass strips through the slits in the wing bottom and running two dowels through the LE and TE (it should be a tight fit) and through the brass strips. Plug the strut clevises into anchors in the bottom longerons. Adjust as required to align with the stab.

Make the short vertical struts out of wire. Invert the plane and hang these near the midpoint of the wing struts, parallel to the fuselage CL. Poke them through the wing bottom. Adjust and trim their lengths, if needed. Silver-solder the bends to the wing struts.

Cut soft sheet-balsa fairing strips for the wing and cabane struts and landing gear. Center a shallow V-groove in each, then gouge it to a half-round with strut-size wire. Fit the strips, and sandwich the wire between them with CA. Sand them all to streamline the cross-section.

Build scrap-balsa mandrels the shape and size of the fillets with 2-inch necks like the struts. With a heat gun, shrink battery shrink-wrap on these. These fillets slide over the struts to cover the clevises and the gap between the gear and the fuselage. Later, after covering the tail, CA 1/16x1/4-inch balsa to two bamboo skewers, streamline them, poke them through the MonoKote and CA them between the bottom longeron and the fin. Slit a scrap of plastic tubing and CA it over the tailwheel strut between the pant and stringers.

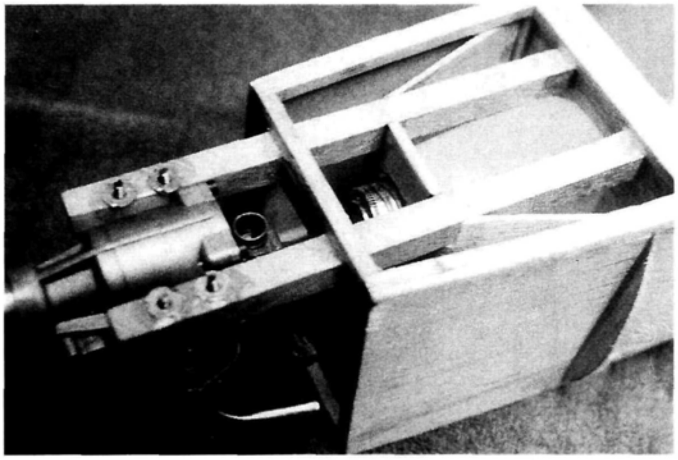
SUPERSTRUCTURE

On the full-scale Ar.76, cowls and removable sheet metal over formers made up the rest of the plane. For me, the easy way was to piece it together from soft sheet balsa and parts salvaged from another plane. A Skybolt ABS top, available from Sig, yielded both the top rear fuselage where the headrest flows into the vertical fin and a perfect removable belly pan for the engine cowl.

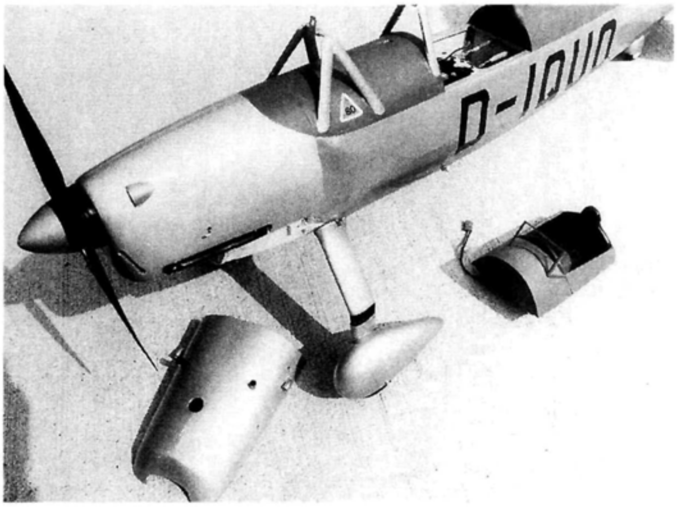
Cut about 4 3/8 inches off the rear of the molded ABS top (at the base of the curve) and slide it down the fin. Carefully cut away the inside, following the curve of the fin, until the bottom rests on the longerons. Bend a 3/8x8-inch strip of thin ABS at the center, and fit it inside to extend the upper walls to match the plan. When everything fits, CA it all together. Reroute the rudder Gold-N-Rod to exit through the right side of this.

The deck and headrest behind the cockpit are just three formers connected by strips of soft balsa. On the plan top view, join the formers with two strips at the side bottoms, a center strip at the top and two more at the base of the headrest. Checking the fit on the fuselage as you go, fill in between these with beveled and tapered strips. Sand the outside contours and remove excess inside wood. Fit the deck into the fin fairing, and CA it in place on the longerons. Add the front plate.

Build the deck forward of the cockpit on



Top view of the bulkhead at the neck of the fuel tank, motor mounts and inner walls of the cooling tunnels.



Finished fuselage with cockpit hatch cover and Sig Skybolt belly pan removed. Note faired struts, dummy exhaust and gear leg fillet.

the fuselage. CA a balsa spinner-size ring to its backplate. CA a plywood ring (same o.d.) to the balsa. Put the spinner on the engine (spacer replacing prop, openings taped) and mount the engine. CA the formers to the crosspieces. Tie top formers to the top of the ply ring with a center strip. Check the curve with the plan. If it doesn't match the side view, fix it now. Build up a block of soft sheet behind the ply ring, and carve the triangular nose-bowl like that of the full-scale AR.76's inverted, air-cooled Argus V-8.

CA two more strips, interrupted by cabanes, on the longerons at the ends of the formers. Extend them to the sides of the nose-bowl block. Check the curves with the top view. Fill in between these with beveled and tapered strips and sand to shape. The rest of the cowl forward of the cabanes and slotted blocks is made of sheet balsa and the belly pan. To create the pan, saw the front 7 inches off the Skybolt top and split this down the center. Narrow its front by removing a 3/4x7-inch wedge from the inside of each half and rejoining the halves with CA. CA a scrap ABS strip inside to reinforce the joint. Square off the rear of the pan.

Test-fit the pan. Round the fuselage side walls and longerons to make it fit the engine's rocker cover and the formers at the front and second crosspieces. CA two pan pads (gill former to nose block) to the outer walls so the lower half supports the pan's upper edges. CA four hardwood blocks to the outer walls below these pads, at the front and gill formers. Round them to fit, press the pan into position, and drill four 1/32-inch-diameter holes through the pan into them.

Enlarge the holes in the pan for servo screws, and mount the pan. CA the sheet sides and longeron in place. Scribe a line across the top of the deck at the end to simulate a cowl break. Sand the nose to shape. Cut out the exhaust slots on the bottom at the pan. Finish the cooling-air intake. Remove the pan and cut a glow-plug-heater hole in it, centered 2 inches behind the nose-bowl break. Reinforce the screw-hole area and rear edge with scrap ABS. Cut a needle-valve hole, then remove the spinner and all traces of the balsa disk. Remove the engine and fuelproof the inside of the compartment, tunnels and gills with CA.

Build the cockpit as a removable hatch on the radio compartment. Cut a sheet-balsa rectangle to fit inside the hole and another (cross-grained), 1/2 inch wider. CA them together with 1/4-inch overlaps. Trim this floor to just span the longerons. CA the seat-back, front former and decking to it, using the hole as a jig. Sand it to blend with the front and rear decks. Simulate a roll of padding on the front edge of the cockpit with scrap balsa. Mount the radio switch in the floor, forward of the servos. CA a block under the center of the right longeron and install a Goldberg* angled hold-down (end slot). After you cover the model, CA two thin ABS trim tabs to each aileron, and a long one with center pushrod and horn to the elevator.

FINISHING

Paint the engine compartment with white Aerogloss* and add scoops, cooling slits and dummy exhaust manifolds (my 4-cycle exhausts through the front end on the left). Prep all other balsa and ABS areas to be painted with Hobby Poxy* Stuff cut 50/50 with methanol, and sand to a metal-like surface. Mask and spray these with Aerogloss aluminum dope. Paint the cockpit interior, prop, spinner, exhaust manifold, gun trough, etc., with Formula U flat black. CA the windshield into place.

Cover the wing, tail and lower fuselage with aluminum MonoKote. Mix flat tan and olive-drab Formula U to paint the green/brown windshield frame and anti-glare panel around the cockpit. Cut the markings out of MonoKote trim sheets.

From 1933 to 1936, registration codes for this class of aircraft all began with D-I followed by three letters assigned at random. The all-silver first prototype Ar.76 was D-IRAS. Subsequent Ar.76s had the brown/green panel around the cockpit. With the onset of war, field conditions cost them their silver paint and wheel pants. They flew into oblivion in training squadrons, pantless and dressed in earth tones.

THE PAYOFF: FLYING

I used up my first tank of fuel taxiing across my lawn and up and down a blacktop street to check power, cooling, rudder response, tracking and range. Acceleration was so good with the scale-like 10x6 Tornado show prop that I left it on for the first flight—and it's still on! I know the engine would do better with less prop, but that black prop with the yellow logo goes so well with the black and silver spinner!

At the field, I pointed it straight into the wind, with a little right rudder and enough up-elevator to prevent it from tripping in the grass, and opened the throttle. In 20 feet, it was flying straight and true, fast and solid as a rock. No trim corrections were needed. We wanted pictures, so I made low passes and 180s until we were out of film. With the engine idling, the landing was uneventful. The lifting stab helps.

At a fly-in, I found that the tall landing gear could get you into trouble when a photographer knelt directly upwind of me on takeoff. I had to do some tight maneuvering to miss him; I hooked a wingtip and cartwheeled. No damage, but lots of embarrassment. The plane has proven to be too stable to be fully aerobatic with the original power setup, but it sure is realistic. It won't do anything vertical and even wants to roll out of the top of loops. For the upcoming season, it has a new O.S. .26 Surpass (interchangeable with the FS .20) and may even get a different prop. The fun never ends!

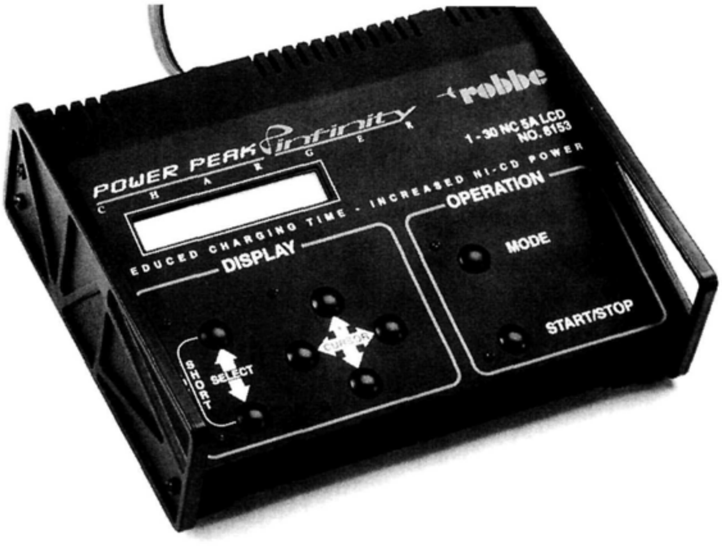
**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

MODEL AIRPLANE NEWS
HOW TO

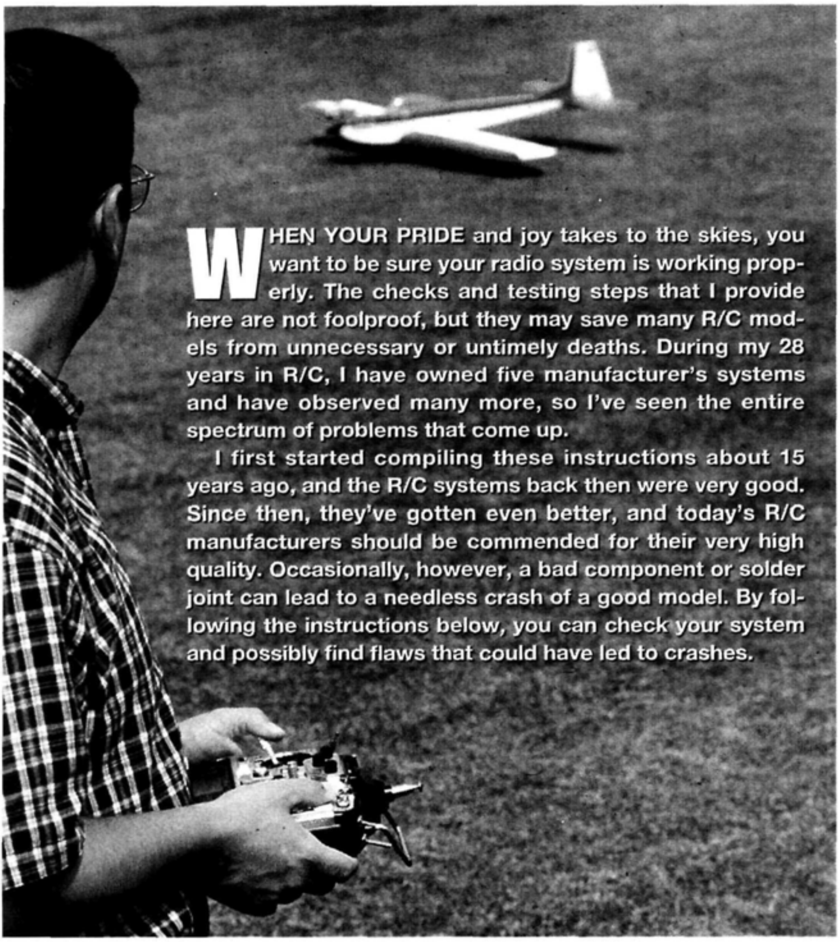
by Don Edberg

R/C System Maintenance

8 preflight steps to glitch-free performance



A battery charger/cycler, like this unit from Aveox, is a must to keep batteries in top performance.



When your pride and joy takes to the skies, you want to be sure your radio system is working properly. The checks and testing steps that I provide here are not foolproof, but they may save many R/C models from unnecessary or untimely deaths. During my 28 years in R/C, I have owned five manufacturer's systems and have observed many more, so I've seen the entire spectrum of problems that come up.

I first started compiling these instructions about 15 years ago, and the R/C systems back then were very good. Since then, they've gotten even better, and today's R/C manufacturers should be commended for their very high quality. Occasionally, however, a bad component or solder joint can lead to a needless crash of a good model. By following the instructions below, you can check your system and possibly find flaws that could have led to crashes.

STEP 1. **READ THE INSTRUCTIONS**

Before you do anything, carefully read the instruction manual cover to cover. If your system is secondhand, borrow a copy of the manual or get one from the factory. You will probably find some useful tidbits that you weren't aware of—especially if this is your first R/C set. If the system has any special features, such as mixing, special rates or switches, timers, bells, or whistles, reading the manual is the only way to learn how to properly use them. Learn as much as possible about the system; you can also buy an aftermarket book on the radio. Investing a few dollars here will provide you with invaluable information that can save an airplane later.

Ask your modeling friends if there are any special features or problems with your system. If you have Internet capability, ask a news group (such as rec.models .rc.air) or discussion forum for comments.

I once received some very expensive electronic testing equipment for the laboratory where I work. The instruction manual was packed in a plastic bag along with a bright red sign that said, "Try it our way first."

STEP 2. CHARGE AND CYCLE THE BATTERIES

Plug the charger into a wall outlet, connect the batteries, and let them charge overnight. If you fully charge the batteries and they're in reasonable shape, they will last a certain amount of time at the flying field. Obviously, you don't want to exceed this time when the model is airborne, or you risk losing control and crashing.

If you have JR* and other brands of R/C gear, don't swap charging components. JR transmitter charging circuits are wired differently from all other R/C manufacturers. If you mix a JR charger with another manufacturer's transmitter, you may blow a fuse or cause worse damage. Do not mix JR and non-JR R/C charging equipment!

Buy, beg, borrow, or steal a battery-cycling system! Many crashes are caused by batteries with low capacity. After an overnight charge, cycle both the transmitter and receiver batteries. You should get at least one hour of operation for both the transmitter and receiver pack. A fresh transmitter pack should last at least two hours, although this varies quite a bit between makes and models. The receiver duration also varies, depending on the number of servos used and how often the stick is moved (the more control inputs, the more current is consumed).

If you can't buy or borrow a cycler, you can obtain the system duration the old-fashioned way: turn on the transmitter and airborne system with as many servos plugged in as you can find, and keep moving the sticks continuously until the servos stop responding (sometimes it helps to sit in front of the television so you don't get quite as bored!). Eventually, either the servos will slow down (meaning the airborne battery is running out of juice), or they'll stop entirely (the transmitter has run out of battery). Note the time since you turned the system on; this is an indication of how long it will operate. If it lasts less than an hour, consider replacing the offending battery pack before you try to fly with it.

Note that short airborne battery duration may also be an indication that your pushrods or control surfaces are binding. If the servos seem to be working very hard even at the start of the discharge, make sure the controls aren't binding somewhere. This can kill a battery very quickly and cause a crash—even with a freshly charged system.

STEP 3. **MECHANICAL INSPECTION**

Start with the transmitter. Examine the motion of the sticks carefully: look for "stickiness" (no pun intended) or hesitation and restrictions or sounds as you move them. Make sure the antenna easily extends and collapses, the trim tabs are easy to move and center and any other switches are easy to operate and not bent or broken.

Now look at the receiver, servos, battery and switch wiring. Make sure that all of the pins on all of the connectors are clean and shiny, not corroded or bent. Check for cracks or broken wire insulation near the receiver case, servo cases, battery wiring and in the servo and switch wires. These types of defects usually occur where the wires exit the case. Gently rotate the servo arms back and forth to check for slop, but if they won't move easily, do not force them. We'll look at the servos in more detail later.

Often, there are little balls or blobs of conductive solder or pieces of wire in new transmitters, receivers and servos, any of which could cause a problem if they shorted out the wrong contacts inside the part. It can take a while to open up the case and inspect each item with a magnifying glass, but it's well worth it. There isn't time for the factory to do this inspection; if the system passes the bench test, it is packed and shipped. Later, the "conductive metal freebies" can rattle around and cause problems. If you carefully open and close the case, you won't void your system's warranty. Most system manuals tell how to remove the transmitter's rear cover. You might also want to *carefully* open the receiver and servo cases to look for loose pieces of metal.

STEP 4. **CHECK THE TRANSMITTER OPERATION**

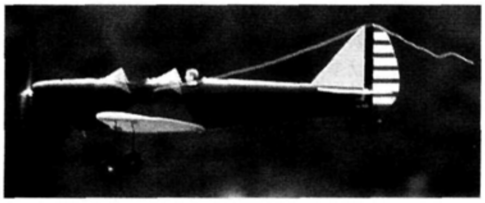
With the system's batteries fully charged, turn on the transmitter. Plug a few servos into the receiver and turn it on. Gently tap on the sides, top and bottom of the transmitter case while watching the output meter reading (if there is one) or listening to hear the servos "jump." If something happens, there is a loose or intermittent connection somewhere inside the transmitter. Don't try to fly without finding the problem.

Pull up gently on the antenna and watch the meter or listen to the servos. I have seen and owned several transmitters where the connections to the antenna were cracked and only worked part of the time. It is normal to see a changed reading when you touch the antenna, but the reading should never drop to zero. The meter may also change depending on how you hold the transmitter. Make sure the antenna is fully engaged in its extended position: read the manual to find out for sure.

Some antennas swivel, and there's a screw that controls the friction. If this screw is too loose, the antenna connection may become intermittent. Keep this screw as snug as you can.

STEP 5. **CHECK THE AIRBORNE SYSTEM**

Continue with the system power turned on. Be sure that the receiver antenna is uncoiled and stretched out to its full length. Gently pull on the antenna wire at several locations, starting at the free end and working toward the receiver, again listening for any servo motion. Tap on the receiver case with a pencil and listen for any servo motion.



Gently pull on each servo wire where it is attached to the connector and the servo case. Do this with the switch and battery wiring as well. You're trying to find any broken or nearly broken wires.

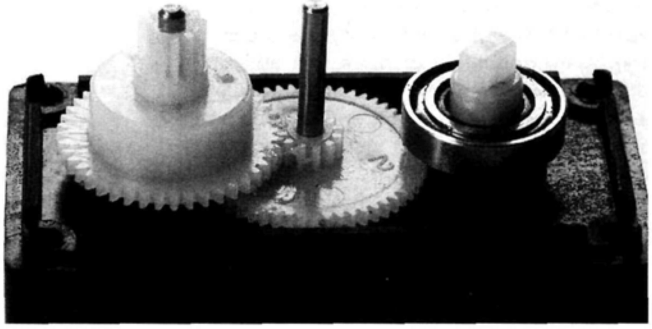
STEP 6. **CHECK THE SERVO OPERATION**

Now move the sticks and listen to the servos move. Grinding sounds or slow, erratic motion are signs of trouble. All servos should move at the same speed. Randomly cycle the sticks to give the servos some exercise. If the transmitter has a "slow-cycle" option, let it run for at least 10 minutes. If you have a servo cycler (these are sold by several manufacturers; I've had great luck with one made by ElectroDynamics*), cycle each servo at least 5 or 10 minutes, using both slow back-and-forth and rapid end-to-end slewing functions, if available.

Any servo that stops moving (with the radio or cycler on) has a "dead spot" in its motor. This means the contacts inside the motor do not conduct electricity when the armature is at a certain spot. Don't fly with this, as it's a guaranteed crash waiting to happen!

If you don't have the slow-cycle feature, you still need to test for dead spots. Move the transmitter stick all the way over. Now, as slowly and as smoothly as you can, release it so that the servo is just barely ticking over. Repeat on the other side, and repeat in both directions several times. At any time, if a servo stops moving, you have found a dead spot. Mark the servo with tape, or tie a knot in the connector wire so that you won't use it before it is fixed. The cure is simple: replace the motor or replace the servo! If the servo is new, take it back to the dealer and demand a replacement. It helps to leave the servo at the position of the dead spot, so you can demonstrate the problem. If the servo is used, have the motor replaced by an R/C repairman.

Another way to test for dead spots using a computer radio is to use the throw volume or endpoint adjust functions. Move the stick or lever all the way to one side with maximum throw commanded, and then reduce throw one unit or percent at a time by pressing the proper buttons. This will command very small, slow servo motion.



If the servo motion doesn't sound right, carefully open the case and check for problems such as dirt and broken gears.

During these tests, also listen for "nervous" servos, which are often caused by a dirty potentiometer or a pot wiper that doesn't make contact inside the servo (or transmitter). To tell whether the problem is in the transmitter, plug another servo into the same receiver channel. If the nervousness repeats, the problem is in the transmitter; if it doesn't, the problem is in the first servo. Again, don't fly until these problems are fixed!

Servo wires can often become frayed where they exit the servo case; using this servo could result in a crash!

STEP 7. **GROUND RANGE TEST**

Your system must be tested at operating range. Before installing a new system into your favorite plane, try to find an old model that you don't care too much about so that you can fly it comfortably. You must consider the model to be expendable because if you do experience a range problem, it is very possible that you will crash and damage or destroy it. But that is much better than losing a brand-new model, isn't it?

If you're new to R/C airplanes, it's very important to get an experienced teacher to help you set up your radio, go through these checks and help you learn to fly, too.

Install the radio, taking care that the pushrods, control surfaces and the model itself are all in good shape. If a problem does occur, you want to be sure that it's in the radio system and not a loose hinge, sloppy control horn, flapping pushrod, or loose or broken control surface. Be sure that the batteries are fully charged. Tie the fully extended receiver antenna wire to the top or the vertical tail. Let the excess wire trail off; do not fold it, cut it, or coil it. Wrap the receiver in soft padding, and make sure all the servo connections are secure and won't become loose under vibration.

Place the model on the ground with its nose pointing toward you and as far away as possible from metal objects, other transmitters and people. Grass or dirt is best, because concrete often has steel reinforcing bars embedded within it, and these can mess up range. Do not let anyone hold the model—the person who holds it increases the signal the model receives (how much depends on how they hold it, etc., and can vary). Keep people 10 or more feet away. Collapse the transmitter antenna, turn on the transmitter and receiver, and choose a control movement that is visible from far away.

Now, as you move the control back and forth, slowly walk away from the model. Keep the base of the transmitter firmly pressed on your stomach. This provides a good electrical ground and increases your range. Continue walking away from the model until the control no longer moves or becomes nervous or jiggly. You may find it helpful to recruit an assistant to listen for servo nervousness and give hand signals to indicate servo motion if you get very far away, but keep him 10 feet away from the model, too.

If you have a "rubber duck" transmitter antenna, you will have to walk a long way to find the range. You can temporarily cut the transmitter range by putting a metal pipe over the antenna. Your range results will vary with the pipe size and length, so it doesn't hurt to do a check the first time with nothing over the antenna, then repeat with the pipe shielding the antenna. Keep the pipe so that you can make comparison checks from time to time.

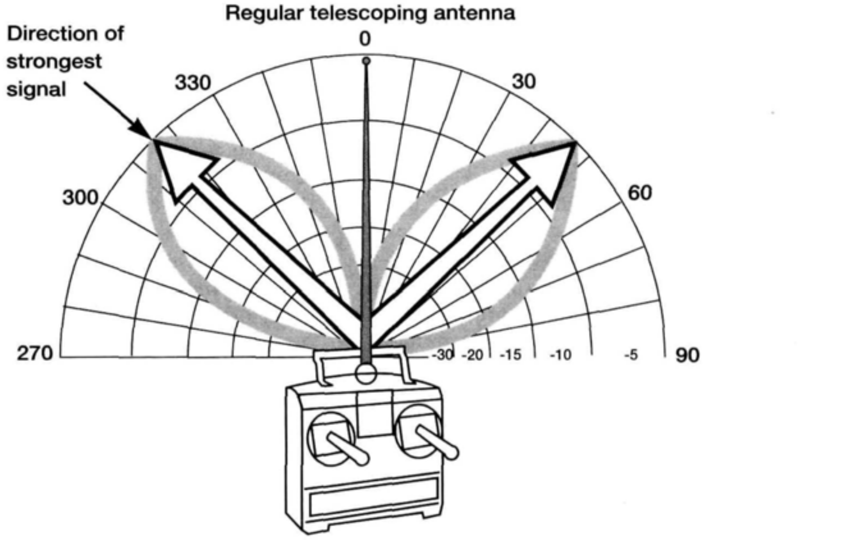
If you have a PCM radio, range testing is very easy. Just set the model up so that a visible control goes to full travel for fail-safe. Then, just walk away from the model with the transmitter, continuing until the control moves, indicating that the model is now out of range. When this happens, you will find that you have to go quite a way back toward the model to regain control. This is normal with FM and PCM radios and is known as hysteresis. (Don't forget to reset the fail-safe position after you've completed the ground testing.)

The distance to the model when the control is lost can vary tremendously among different makes and models of radios. Many radios go 15 to 30 paces, depending on how much of the antenna is exposed outside of the transmitter, etc. The approximate range may be specified in the instruction manual, but it is better to do your own test so that you know how your system works. Count paces as you walk away from and back to the model, and write down the number. You should check range regularly, at each flying session or at least once a month or so. If the range changes drastically, you are likely to have a problem. Don't fly!

When you repeat the ground range test, try to do it under the same circumstances that you used previously. I prefer to do all of my testing on dirt or grass. Often, moving the transmitter up or down, turning you body, or holding the transmitter tight on your stomach will make a difference, as will wet ground and other changes. Try to be consistent each time you do test so you can compare the results.

Figure 1. Antenna strength

Regular telescoping antenna



The radiation pattern for a regular, conventional telescoping transmitter "whip" antenna has the highest strength off to the sides, as shown; therefore, you should never point the antenna directly toward the model.

STEP 8. **FLIGHT RANGE TEST**

If your ground range is adequate (ask the opinion of an experienced modeler, if available), you're ready to flight test the radio. A habit I have acquired is to turn on the receiver first. Although this goes against the manufacturer's recommendations, you will immediately know by the crazy motion of the servos that there is interference ... or another modeler ... on your frequency. If this is the case, do not fly until you have tracked down the other transmitter or verified that there isn't one. Occasionally, there will be outside interference, or noise from long servo leads, that does go away when the transmitter is turned on.

Fully extend the antenna, and make sure the model's center of gravity is in the correct position and that the controls move in the correct directions. Strange as it may seem, many of the crashes I've seen have been caused by reversed throws—not radio problems. For computer radios, be sure that the proper model memory is chosen. You are now ready to put the model into the air.

Take off in the usual manner, and when the model reaches a reasonable height, trim it to fly straight and level. Point the transmitter antenna directly at the model. Pointing the antenna at the model is the worst possible method to broadcast to

the model because the signal strength is weakest in this direction; do not get into the habit of flying this way! If the model suddenly changes direction or you lose control, immediately point the antenna away from the model and hold the transmitter straight up over your head if necessary. The system should work even if the antenna is pointing toward the model when it is over or near the field.

If you have a rubber duck antenna, pointing the transmitter antenna toward the model provides maximum signal strength. So, for range testing only, point the rubber duck well away from the model to minimize signal strength. This is shown in Figure 1, Antenna Strength.

If you retain control of the model, make it zigzag away from you to test your range. If at any time you lose control, just point the antenna away. This is the reason for flying with the "low signal" orientation; you can immediately improve things by changing the antenna orientation.

Have the model make a few circles, and watch it carefully. You may experience a momentary "glitch" when the receiver antenna points directly toward or away from you. This is a somewhat common problem, but it should not be accepted as normal. The suggested cure during test-flying is to hold the transmitter in different positions until control is regained. This can be serious for sailplanes that are a long way downwind and flying directly toward the pilot.

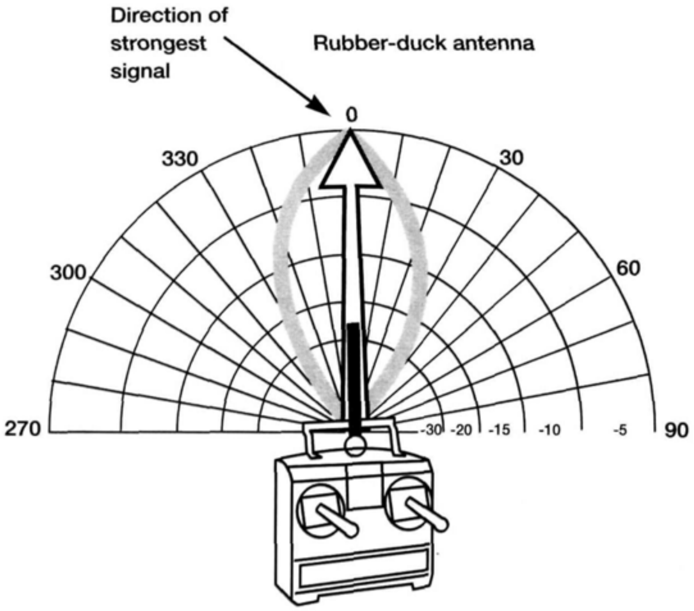
Let the model lose altitude and continue observing it as it nears the ground. You want to test the radio in the same manner that you'll be flying it later. Land the model when you are tired of testing it or feel that it works properly. Repeat the testing several times over different portions of the flying field. If the radio doesn't act up, you can be pretty confident it will be OK later. If it does act up, the problem might be interference at the field, a "lemon" radio set, or a bad installation in the model.

If other modelers on the same frequency have difficulties, the problem is likely to be interference, perhaps from a local paging system, and you may want to consider changing to a new frequency. Otherwise, consider rerouting the receiver antenna (or letting it dangle straight down, being careful not to get it in the prop); using a larger battery pack (sometimes current spikes from moving servos can cause the receiver to temporarily act up); increasing wire size (especially for long runs to servos); or in extreme cases, using filters or signal boosters.

Going through these eight steps will help you determine whether there are any problems with your gear. If there is any reason that you don't feel confident with your system, please don't fly it until the problem is resolved. It's better to wait than to crash!

Remember, if you want to write to me, send an SASE to me c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877 USA, or email me at man@airage.com. I get lots of mail, so please be patient!

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*



The radiation pattern for a rubber-duck antenna is strongest in the antenna direction; therefore, you should always point the antenna directly toward the model.

Weather considerations

Bill Steffes' SBD Dauntless falls prey to the heat and humidity at Top Gun '99, landing dead-stick.

DURING THE DOG days of summer, the complaint-department buzzwords "hot and humid" are often heard. We must remind ourselves that just a few months ago, we would have given just about anything for a nice, warm day.

It's hard to believe how much the weather controls aviation. Because air is the medium in which we operate, its variables, i.e., the weather, affect every one of our performance parameters. If you look at the performance charts in the back of any pilot's handbook, you will find that they all use some type of weather-related factor in the equation. No matter how you look at it, nature still rules. Unfortunately, the air and its associated variables can't be scaled down to meet our particular needs; we are stuck with operating our model aircraft in "big" air with "big" wind and "big" turbulence. With a larger model, the wind becomes somewhat less of a problem, but other factors such as air density become more problematic. Let's discuss these weather factors and how they relate to giant-scale flying.

BLUSTERY DAYS

"Mr. Wind" is almost always the first weather condition a fledgling pilot encounters. You learn about its effects right from the get-go: in turns, straight and level, and especially in reference to the ground during takeoff and landing. We routinely fly our R/C aircraft in conditions that would be considered very windy for scale craft. A 10mph wind on a ¼-scale model equals a 40mph wind on a full-scale plane! If the wind isn't blowing straight down the runway, you could easily exceed the crosswind component—a big no-no in full-scale flying. The crosswind component is a combination of wind velocity and angle of deflection in relation to the intended flight or landing path. The crosswind component is then compared to a number that's given to the specific airframe with regard to its capability to counteract crosswind conditions with rudder deflection and side area. Not being able to keep the plane straight at landing puts excessive side loads on the landing gear and often leads to damaging ground loops. This doesn't cause too much of a problem with spring-wire legs, but side loads can really work over retracts.

Another factor related to wind is ground-effect turbulence that's caused by friction between the relative wind and the ground. This type of turbulence creates a horizontal vortex that precipitates a rolling effect on any plane that flies through it while close to the ground. This, along with a stiff crosswind, can turn a simple landing approach into an exciting exercise in coordination!

When we first learn to fly, we look for nice, calm days so that during landings, we need only worry about when to flare. But as we expand our boundaries and venture out on not-so-nice days, the need for control inputs other than elevator on landing becomes very evident. The two most frequently used methods of countering crosswind while landing are the "crab" and "slip" approaches.

The crab method is more popular because it requires less control input. The crab angle is set on final to counter the crosswind and still provide a straight ground track to the runway. Then, as you begin to round out and flare, kick opposite rudder and dip the upwind wing to straighten the nose just before touchdown. The control inputs are opposite each other and should feel awkward; cross-controlling has to grow on you.

To use the slip, you must cross-control all the way down to final instead of crabbing, so you should be pretty comfortable with the idea. There is also a slight danger associated with using the slip to land. Because our only speed reference is visual, there's a chance that the model will slow down too much and enter an inadvertent approach stall. Any type of aerodynamic cross-controlling washes the plane out, so keep the speed up—especially if you're big and heavy. High wing loading aggravates this situation!

HEAT AND HUMIDITY

To modelers, the effects of temperature and barometric pressure are among the lesser known or understood variables. Together, they regulate the density (or thickness) of the air in which we fly, and this density has a much greater effect on our R/C flying than most of us realize. It can have negative as well as positive effects on all the parameters of flight as well as on engine and propeller performance. In full-scale flight planning, we use the temperature and pressure to calculate what is called "density altitude." By using this number, we can get a good idea of the performance expectations of the airframe and powerplant. This is very important because the available performance dictates takeoff/landing distance and load-carrying capacity. To more easily get a handle on all this, simply think of it this way:

- **Hot and humid** = high-density altitude = poor or lower performance;
- **Cold and dry** = low-density altitude = good performance.

Figure 1. Crab and slip angle for crosswind flight.

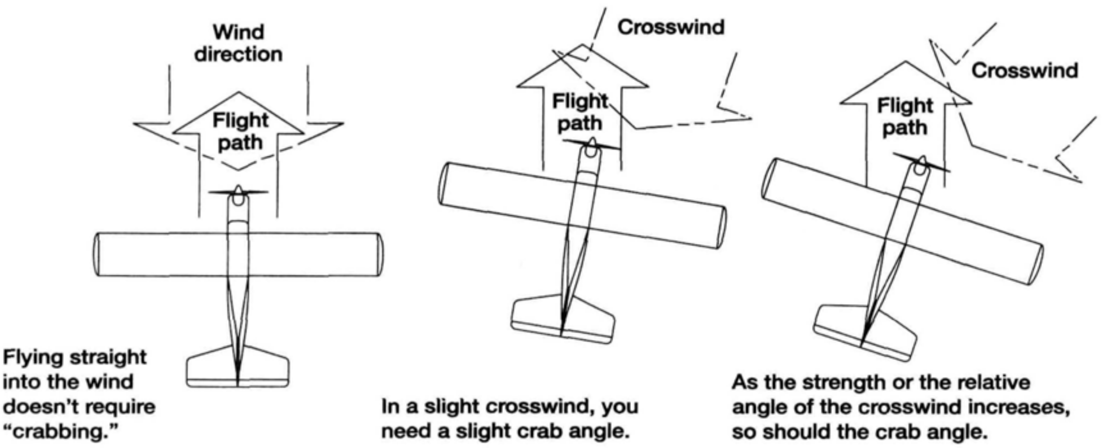
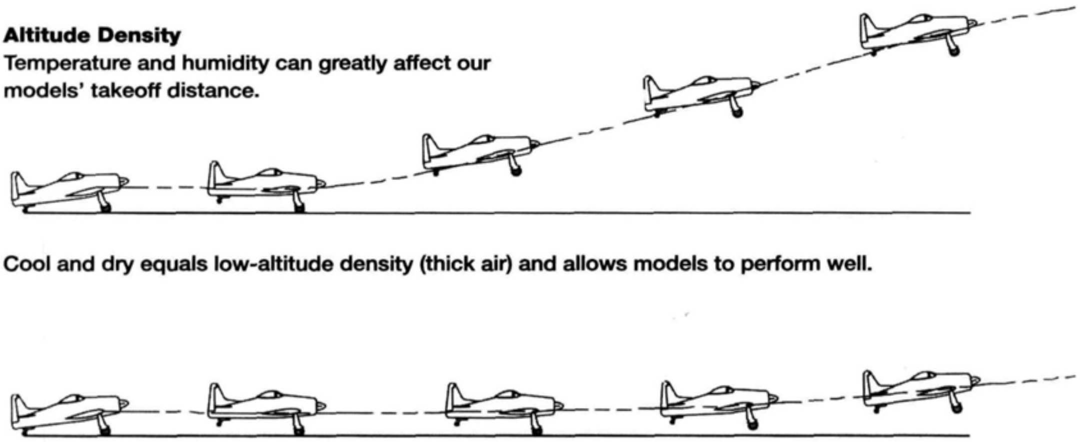


Figure 2. Air density and takeoff distance.



Hot and humid equals high-altitude density (thin air) and hinders our models' takeoff performance.

Most—if not all—basic performance figures published for specific engines and airframes are calculated at 59 degrees Fahrenheit and 29.92 inches of mercury, which is standard pressure and temperature at sea level. Above that temperature or below that pressure, performance declines proportionally.

In R/C flying, the takeoff/landing distance is usually not much of a problem unless you happen to be flying a jet or a heavy warbird that's powered for scale speed. Have you ever wondered why your good 7,000rpm G-62 will sometimes only turn 6,500rpm? How about when your landing speed seems a bit fast, so you slow it down and your model almost falls out of the air on final? For the answer, look to the air density—not to the engine or plan. Engines won't produce as much horsepower and wings won't create as much lift on hot, humid days as they will on cool, dry days. You should especially be careful with your engines when it's hot and humid because it's easy to ruin them. I'll give you a familiar situation: it's hot, the air is thin, and your engine isn't turning up to snuff, so you lean the high-end needle to get it up to normal rpm. You fly a few laps around the patch, and the engine quits or sags and causes an impromptu emergency landing. After checking things out, you find that the engine is so hot, it's melting the cowl! My point: hot, thin air doesn't cool as well, either, so it's easy to cook an engine. At least we in the Midwest only have to deal with the density problem in middle and late summer; pity the guys in Denver (6,000-foot elevation) who live with it year round!

A perfect example of this occurred at Top Gun '99. During the 5-day event, the outside temperature rose from 83 to 94 degrees along with 80- to 90-percent humidity. The barometric pressure also fell five points, and what little wind we had on Thursday had disappeared by Saturday. Many fine scale aircraft fell victim to this high-density altitude situation. Plagued by engine problems—mainly heat—I was able to complete only two of four rounds. I fully understood the circumstances but wasn't able to effect a cure in the limited time available. Many aircraft either couldn't get airborne or, once airborne, were unable to gather enough climb performance to clear the obstacles at the end of the runway. The situation became quite ugly on Friday afternoon during the closing hours of practice. When I returned home, I ran the calculation: the density altitude on Thursday was 3,500 feet; by Sunday, it was at 5,500 feet! Physically, we were in West Palm Beach, FL, but we were flying with the guys in Denver! The moral of the story: don't push a bad situation; if the plane acts as though it doesn't want to fly, don't force it. It knows better than you! The takeoff is optional; the landing is mandatory!

MISSION FORECAST

The weather should be fantastic (as usual) for the upcoming raid on the Air Force Museum in Dayton, OH. This annual fly-in, hosted by the Dayton, Ohio Giant Scale (DOGS) IMAA chapter, has become one of the premier giant-scale events in the Midwest. The site offers a 5,500-foot paved runway and ample pit real estate for the event held over Labor Day weekend, September 3 through 5. It's a perfect spot for three days of low-hassle flying, not to mention the museum, which is open to only pilots and crew on Saturday night! There are lots of area barracks and mess halls available close to the museum facilities. Don't miss the opportunity to fly over the "holy land of aviation." For more info, contact Frank Knoll at (937) 435-9232 or Mark Klingler at (937) 453-2616.

NEW PROJECTS

In collaboration with Col. Art Johnson, Jerry Bates* has released his latest warbird plan: the Martin B-26 Marauder. Drawn to

The Martin B-26 Marauder is a great giant-scale subject that will soon be available in kit and plan form.

⅛ scale, the plan has a 108-inch span, which represents the stretched-wing B-26, B-10 and later versions. The plans are very straightforward, easy to read and follow and should be very "do-able" for any low to mid-time scratch-builder and a breeze for the old hand. Jerry calls for standard balsa and ply built-up construction, and precut kits are now available from Dusty Joe's Precision Aero Kits*. I happen to have one of his kits in hand, and the quality of craftsmanship and wood is superb! Robart* will be producing scale retracts for the plan; these should be available mid-summer. Power recommendations are a pair of Zenoah .23s or .38s, with an all-up weight of between 30 and 40 pounds. If you're in the mood for a good-looking hot-rod in the medium bomber category, this could be your ticket!

See you at briefing.

**Addresses are listed alphabetically in the Index of Manufacturers on page 134.*

The power factor

FOR AS LONG as I can remember, engine manufacturers have advertised horsepower ratings for their products. Unfortunately, this activity has degenerated into a meaningless game of one-upmanship, possessing little—if any—technical merit.

As I complained about this sad state of affairs to my neighbor and partner in aeronautical investigation, Frank Vassallo (remembered by readers of this column as "Professor Physics"), he politely but impatiently allowed me to finish my ranting before he exclaimed: "Dave, the model aviation community has suffered long enough!" Wagging his forefinger for emphasis, he continued, "In the never-ending quest for truth, it's time to arm your readership with a simple, yet elegant, weapon from the uncompromising discipline of physics: the power factor."

"Wow, professor!" I exclaimed. "You mean there's something that can help curious modelers learn the truth about engine horsepower?"

"Yes, Dave; there's a simple relationship between engine power and propeller rpm."

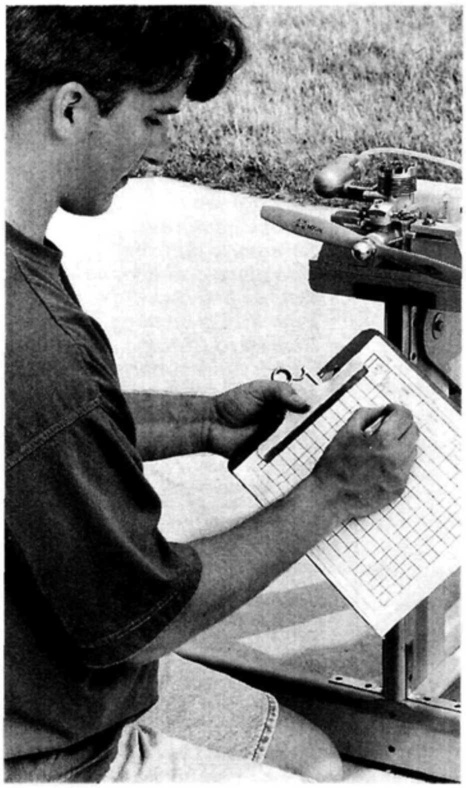
"What's the relationship, professor?"

"Not so fast, Dave. You're not getting off that easy! I'll provide an illustration. When I've finished, *you* tell *me* the relationship. Fair enough?"

"Oh, no, here we go again—Classroom Dynamics 101." (Professor Physics always enjoys a lively game of "Know your concepts.")

The professor snatched a calculator from my workbench and scrutinized it closely, probably suspicious that it was the TV remote control he had mistakenly attempted to use a few years ago. He finally rejected it and pulled out instead a well-worn slide rule from its holder on his belt. After flashing through some calculations, he proceeded to outline the problem on the portable chalkboard he keeps in my shop for impromptu teaching sessions such as this.

"OK, Dave: here's the situation. We have two engines: a sport .35 equipped with a muffler and a racing .40 fitted with a tuned pipe. We've run them both on the same propeller, an APC* 9x6. Both were operated at wide-open throttle with the needle valve carefully peaked for maximum rpm." With a hint of a smile, the professor continued, "The little sport engine spun the APC at a respectable 10,000rpm. At this speed, the dynamometer** tells us that it's producing 0.25bhp. Conversely, the hot racing engine developed 2.00bhp while turning 20,000rpm." With a sardonic grin, he asked, "What is the relationship between power and rpm?"



Immediately above: careful adjustment of the primary needle valve ensures peak rpm for each propeller tested. Above top: record the peak rpm for each of the propellers tested. Rpm data and the bhp constant allow the power factor equation to predict horsepower.

***Note: over the years, I've tested hundreds of model airplane engines on a homebuilt instrument known as a dynamometer. From its operation, the accumulated torque and rpm data allow the calculation of brake horsepower (bhp). The term "brake" indicates that an absorption unit (dynamometer) of one type or another was used to load the engine during an actual test. Occasionally, a manufacturer will supply a torque and bhp graph from its own "dyno," but this is rare. Because the first production gas engines were applied to free-flight model airplanes in the 1930s, the task of providing such information has been left to high-performance engine enthusiasts and magazine columnists.*

Although uncomfortable when put on the spot by the professor, I tried to act as though I enjoyed the challenge. "Let's see; the rpm increased by 10,000, and the horsepower improved by 1.75." I could feel the perspiration forming on my brow. "Ah, let's see ... as the rpm doubles, the power increases eight times."

"That's correct. Now, the relationship; what is it?"

I gazed at the numbers on the dusty board, anxiously searching for a delaying tactic. Just as I was about to excuse myself to mow the lawn, a thought flashed through my mind: wait a minute, I've seen this before. It's a ... that's it! "I've got it!" I shouted, "It's a cube relationship! Power increases as the cube of the rpm!"

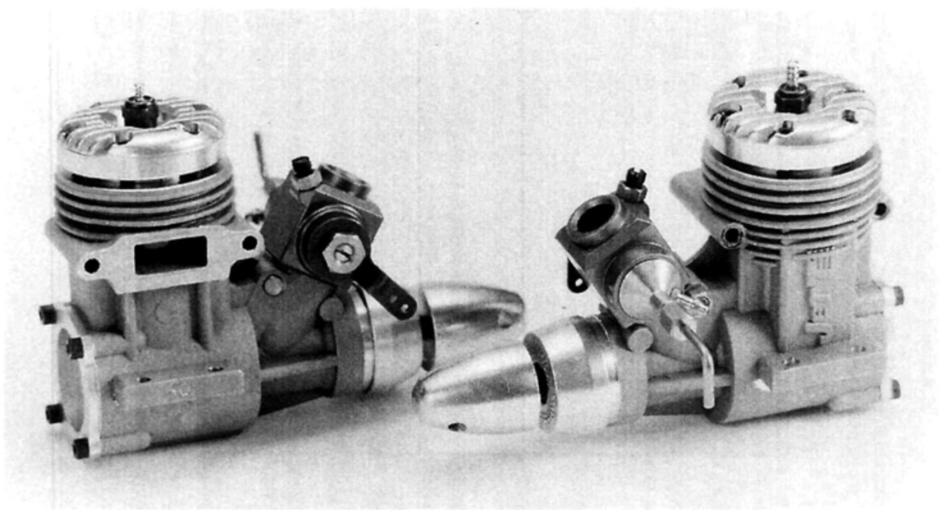
"Good," said the professor, "But take it easy; this isn't a revelation. In fact, it's quite simple." As the professor erased the board with one hand, he scribbled the general power factor equation with the other:

$$\textbf{Power} = \textbf{constant} \times \textbf{rpm}^3$$

"Now that I know the answer, that really was a simple problem, professor. But how does the power factor help modelers unscramble the horsepower-rating mess? After all, your example used dyno horse-

$$P_2 = bhp_1\ (rpm_2/rpm_1)^3$$
$$P_2 = 0.22\ (18{,}900/9{,}000)^3$$
$$P_2 = 0.22\ (2.1)^3$$
$$P_2 = 0.22\ (9.261)$$
$$P_2 = 2.04\text{ hp @ 18,900rpm}$$

With his obligation to physics temporarily satisfied, the professor returned his slide rule to its holder with a flourish reminiscent of a medieval knight, and said, "You can handle the routine material, Dave; I must be on my way. Other dragons to slay, you know." With that, he swiftly turned and exited the shop while muttering something about the problem of squeaky shopping-cart wheels.



PHOTOS BY DAVE GIERKE

The Sport-Jett .46 (above) and Sport-Jett .50 have the same outside physical dimensions. As might be expected, the .50 develops more power than the .46 and is considered to be the "animal" of the series by designer/manufacturer Dub Jett.

A REAL-WORLD EXAMPLE

When I reviewed the Sport-Jett .46 in the June '99 issue of *Model Airplane News*, I also took a look at the Sport-Jett .50. Although I didn't run the Sport-Jett .50, I was able to predict its horsepower from propeller rpm provided by the factory. This is possible because power is proportional to the cube of the rpm ratio of two engines using the same propeller. Therefore, if you know the rpm for each engine and the horsepower for one, you can accurately determine the horsepower of the other. According to Dub Jett, the Sport-Jett .50 turned an APC 11x5 at 15,800rpm. During my tests, the .46 turned the APC 11x5 at 15,000rpm. The Sport-Jett .46 bhp curve (Figure 1) indicates that 1.40bhp is produced at 15,000rpm. Substituting this data into the power factor equation produces an accurate horsepower prediction for the Sport-Jett .50 (see box above right).

$$P_2 = bhp_1\ (rpm_2/rpm_1)^3$$
$$P_2 = 1.40\ (15{,}800/15{,}000)^3$$
$$P_2 = 1.40\ (1.053)^3$$
$$P_2 = 1.40\ (1.167)$$
$$P_2 = 1.63\text{hp @ 15,800rpm}$$

power data for both engines."

"I'm getting to that, Dave. Let's use some new rpm and horsepower numbers for the same engines using the APC 9x6 propeller." As his chalk clattered on the slate, he muttered, "The .35 engine produces 0.22bhp at 9,000rpm, and the .40 turns 18,900rpm. OK; can you solve this one?"

"I don't know; you didn't give the horsepower for the .40."

"That's the point, Dave! If you know the rpm for each engine on the same prop and the horsepower for one of them, the power factor allows you to predict the unknown horsepower." With hands on hips and looking somewhat annoyed, he continued, "Here's the version of the power factor equation that everyone can use to ferret out the horsepower frauds," as the chalk again danced across the board.

$$\text{Power} = \text{constant (rpm)}^3$$
$$P_2 = bhp_1\ (rpm_2/rpm_1)^3$$

"By multiplying the constant—known bhp—by the cube of the rpm ratio—unknown hp rpm divided by the known bhp rpm—the unknown horsepower can always be determined." Again, the professor's chalk rattled across the board.

POWER FACTOR AND MANUFACTURER RATINGS

There are at least two good ways to use the power factor. As mentioned previously, one involves checking engine horsepower ratings from manufacturer ads.

An engine is advertised to produce 2hp at 15,300rpm. The manufacturer claims that it spins a 10x6 APC propeller at 15,300rpm. With this information in hand, let's use our newly acquired knowledge to determine if this ad has merit. Use the Sport-Jett* .46 bhp graph (Figure 1) and the APC propeller rpm data from the Sport-Jett .46, listed below:

Prop	Rpm
9x7	17,500
9.5x6.5	17,000
10x6	16,700
9.5x7.5	16,500
10x7	15,300
11x5	15,000
10x8	14,300
12x6	10,500

Note: the best propellers offering repeatable pitch and diameter specifications are made out of reinforced plastic in a mold. APC props are an excellent example and are often cited by manufacturers and engine columnists.

Again, if you know the rpm for each engine and the horsepower for one of them, you can find the horsepower of the other. From the rpm data chart, the Sport-Jett .46 turned an APC 10x6 at 16,700rpm. The advertised engine turned the same prop at 15,300rpm. From the Sport-Jett .46 bhp graph, the engine is found to produce 1.50bhp at 16,700rpm.

$$P_2 = bhp_1 (rpm_2/rpm_1)^3$$
$$P_2 = 1.50\ (15{,}300/16{,}700)^3$$
$$P_2 = 1.50\ (0.9160)^3$$
$$P_2 = 1.50\ (0.769)$$
$$P_2 = 1.15\text{hp @ }15{,}300\text{rpm}$$

This is only 57.5 percent of the ad's claim of 2hp!

YOUR ENGINE'S HORSEPOWER

Determining the horsepower characteristics of one of your own engines is another good application of the power factor equation. This is accomplished by comparing the engine's rpm performance to that of a published review engine. The task is similar to earlier examples, with one exception: you must actually run your engine and collect rpm data with the same propeller sizes as were used on the review engine. To be meaningful, the review engine must have an honest bhp curve derived from a dynamometer torque test (see Figure 2).

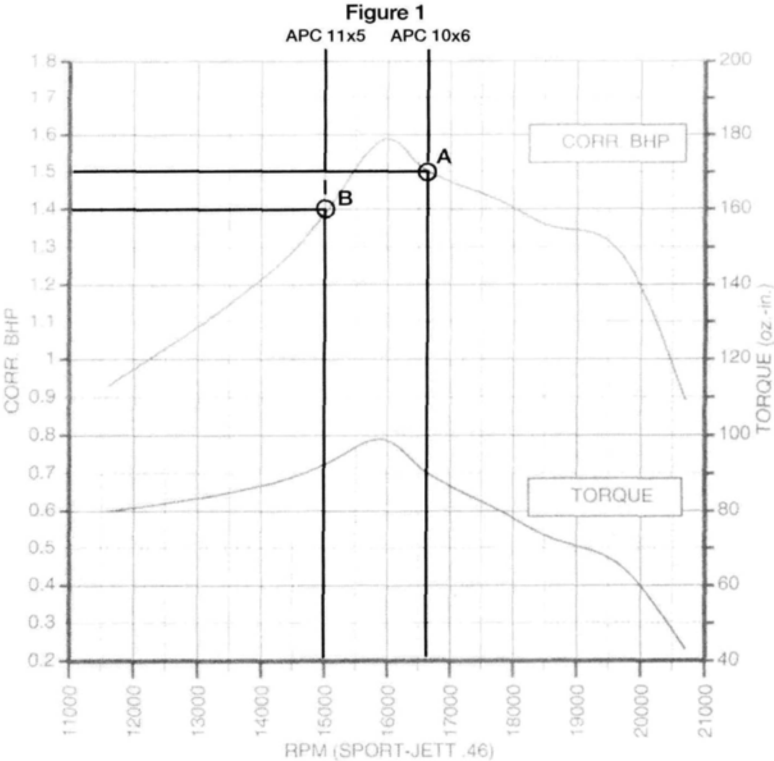
I have compiled APC propeller rpm data for a make-believe engine we'll call "sample .60." The equally anonymous Brand X .60 review engine has been bench-tested for rpm with the same propellers; rpm data for these engines are listed in the chart to the right, along with the dynamometer-generated bhp data from the sample .60 graph.

As with previous examples incorporating the power factor equation, horsepower calculations for the Brand X .60 were generated for each propeller size. From this information, the Brand X horsepower curve was plotted (Figure 2), allowing its performance to be compared with the sample .60. An analysis of this comparison illustrates the techniques' usefulness: although the sample .60 develops more horsepower at higher rpm, the Brand X .60 peaks about 2,000rpm earlier and generates more horsepower below 14,000rpm. This allows the Brand X .60 to turn relatively large propellers with greater authority than the sample .60. The sample .60 is better suited to spinning smaller, low-load propellers at higher rpm, where it can make use of its peak bhp advantage.

With newfound knowledge about the power factor, multitudes of modelers can finally demand truth in advertising from offending manufacturers and distributors of model engines. This, combined with the ability to analyze the performance of personal powerplants, should provide additional breadth and flexibility to individual modeling activities.

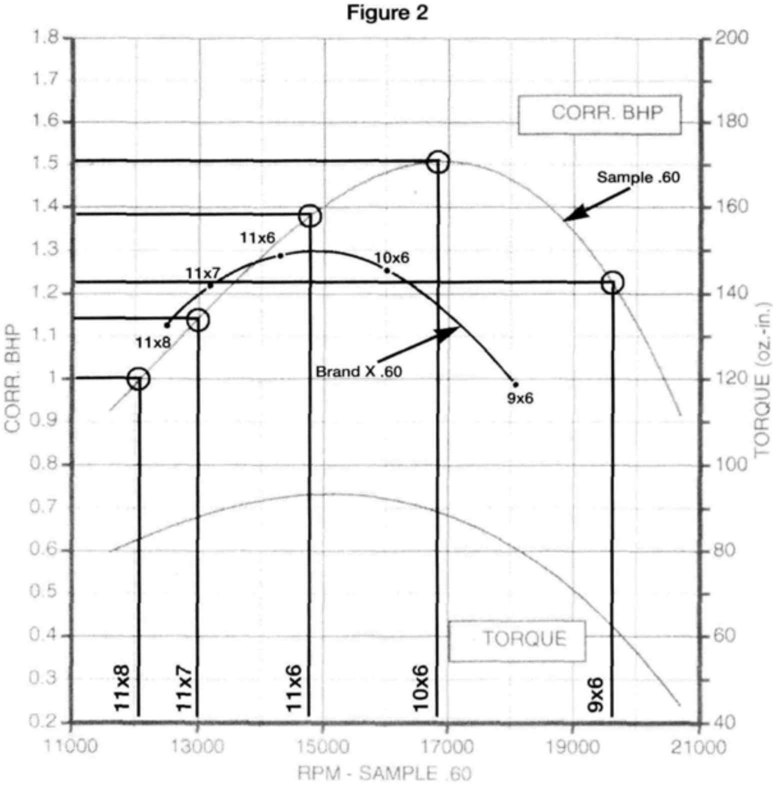
Addresses are listed alphabetically in the Index of Manufacturers on page 134.

Figure 1



APC prop	Sample .60 rpm	Brand X .60 rpm	Sample .60 bhp constant	Brand X hp @ rpm
9x6	19,500	18,000	1.25	0.99 @ 18,000
10x6	16,900	16,000	1.50	1.28 @ 16,000
11x6	14,800	14,500	1.38	1.30 @ 14,500
11x7	13,000	13,300	1.15	1.23 @ 13,300
11x8	12,100	12,600	1.00	1.13 @ 12,600

Figure 2



by Pat Tritle

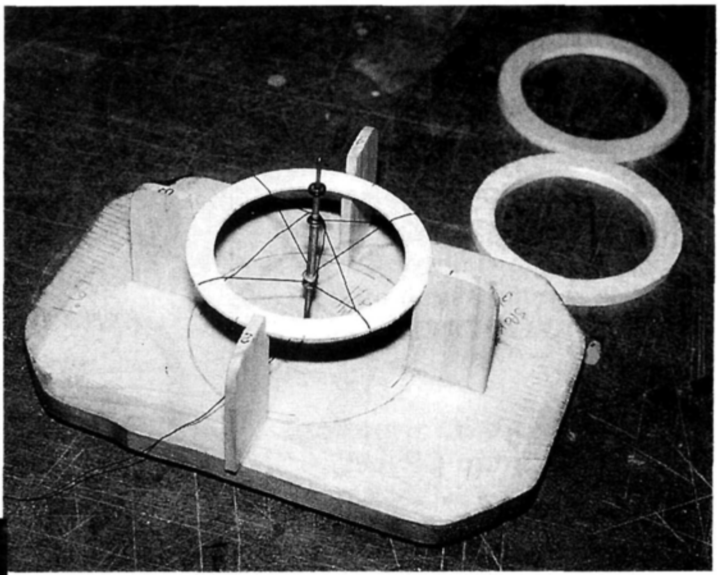
Made by Pat Tritle of Pat's Custom Models*, the spoked "wire" wheels on this Eastbourne Monoplane are lightweight and easy to make.

WHEN I DESIGNED THE Eastbourne Monoplane, it was obvious that to do the job right, it just had to have spoked wheels. The Eastbourne is a Speed 400 schoolyard scale model, so the wheels needed to be light, and I wanted something that was simple to build.

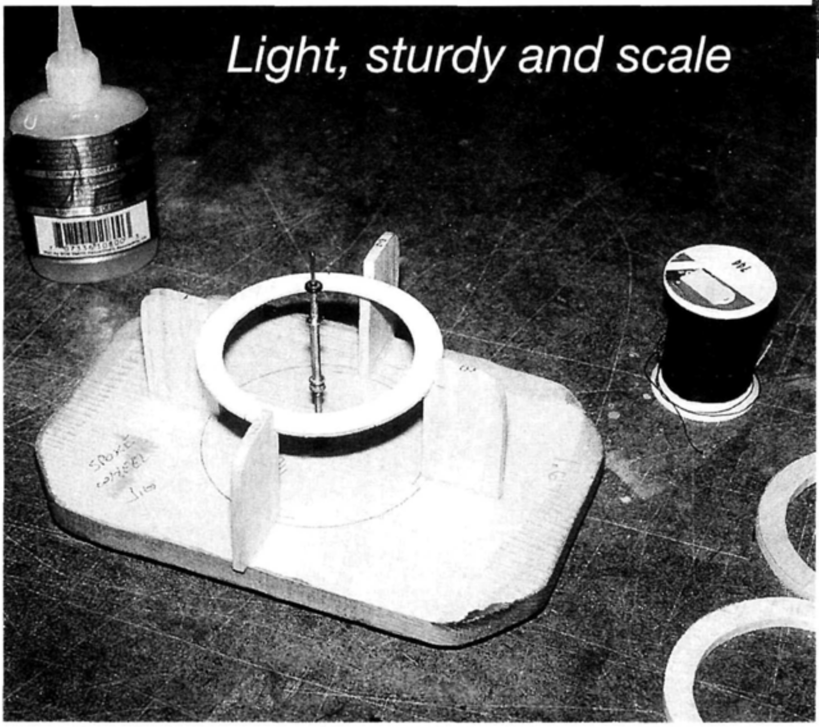
The wheels I designed are made out of a 1⁄16-inch-thick plywood ring with 3⁄16-inch-thick balsa "tire" halves on each side. The hub is made out of brass tubes and washers and can be soldered together or assembled with 5-minute epoxy or thin CA; the one-piece spokes are made of heavy-duty black thread.

Custom-build spoked wire wheels

Light, sturdy and scale

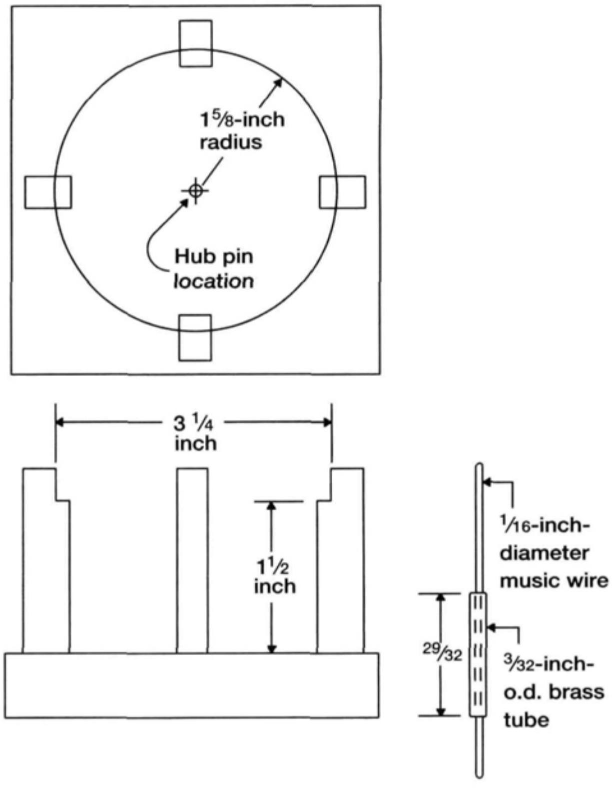


2. I've started to lace the heavy-duty thread around the core to make the spokes. Work slowly to ensure equal tension around the ring. See Figure 3 for more details.



1. You'll first need to build a simple jig to keep the hub and center plywood ring aligned throughout the lacing process. I built this jig out of pine and paint-stirring sticks. The center pin is 1⁄16-inch music wire with a brass tube spacer to center the hub in the plywood ring. Here, the hub has been mounted to the jig, and the center plywood ring has been tack-glued in place. The two balsa rings to the lower right will later become the "tire" halves.

Figure 1. Wheel jig



3. All the spokes are in place. Now, carefully remove the ring from the jig and spin it on a piece of wire. Carefully true it up, then put a drop of thin CA where the spokes meet the hub at each side.

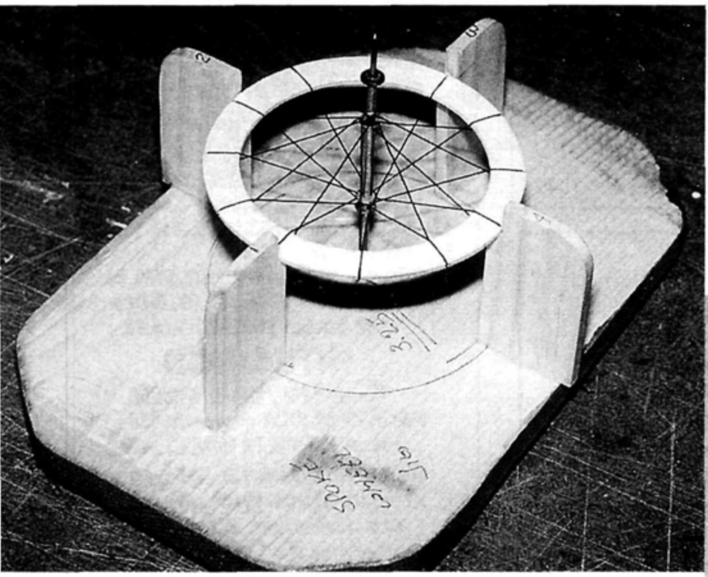
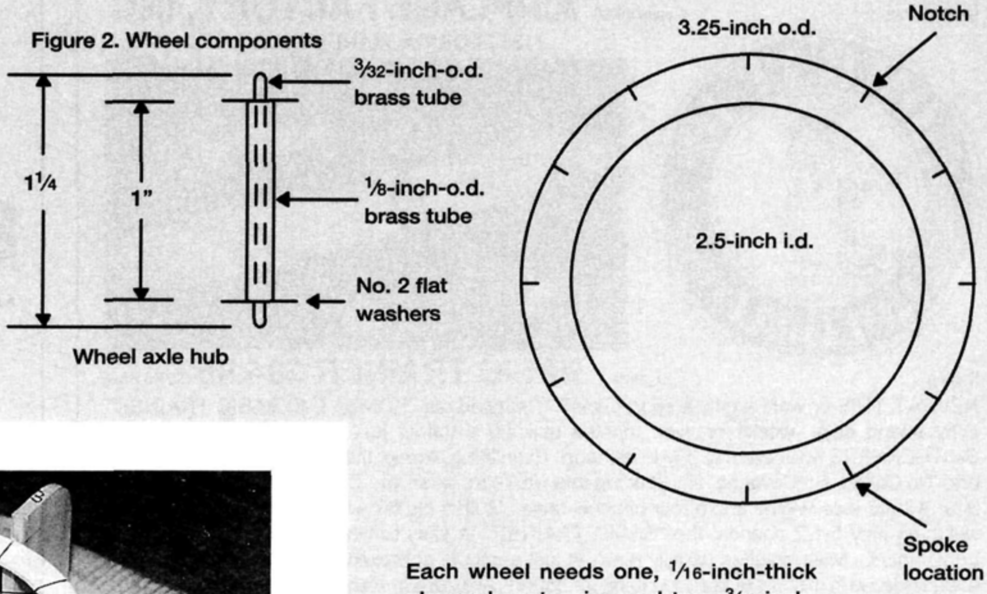
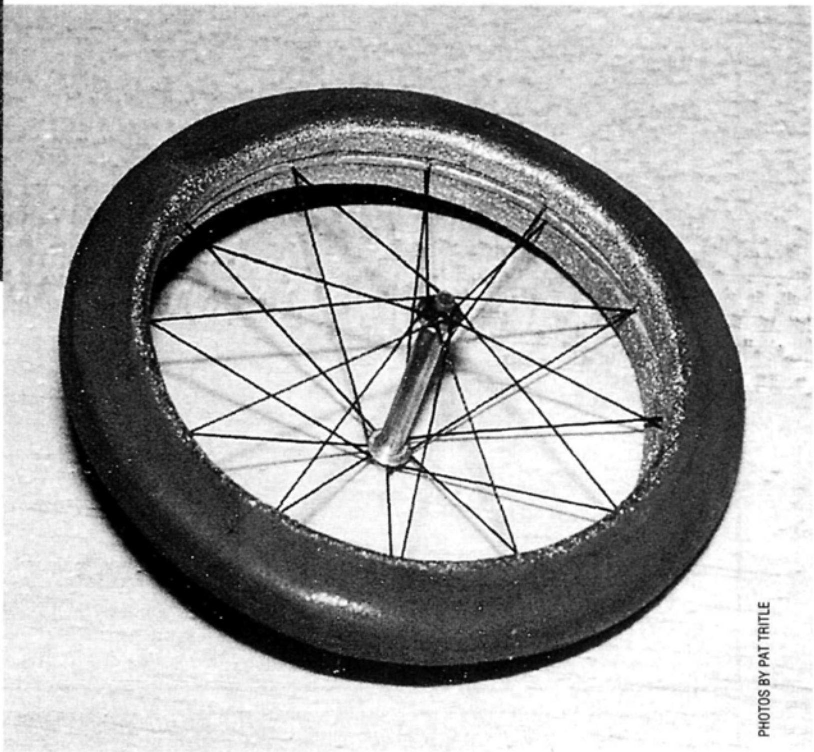


Figure 2. Wheel components



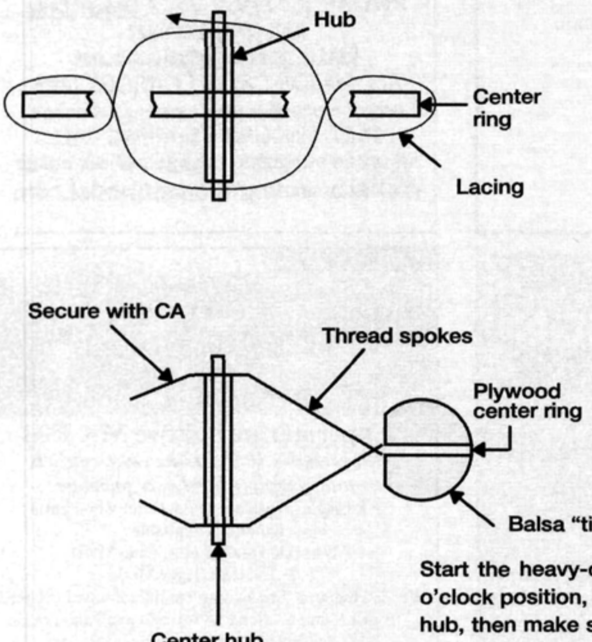
Each wheel needs one, 1/16-inch-thick plywood center ring and two, 3/16-inch-thick balsa "tire" halves.



PHOTOS BY PAT TRITLE

4. After the balsa tire halves have been glued into place and the wheel has been detailed with enamel or water-based paints, it's ready to be mounted on your landing gear.

Figure 3. Making the spokes



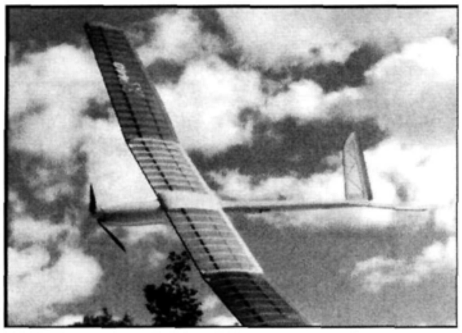
Start the heavy-duty thread at the hub. Make one upper and one lower spoke in the 12 o'clock position, then make an upper and lower spoke at 6 o'clock. Return to the left of the hub, then make spokes at the 1 o'clock and 7 o'clock positions. Repeat until all 12 sets of spokes are in place, then secure the threads at the top and bottom of the hub with CA. Use only one piece of thread for all the spokes.

SR

When was the last time you were sorry you bought the best?

You probably know SR Batteries for our receiver, transmitter, and electric flight battery packs. In all phases of the R/C Hobby they are accepted as being the best. However, you probably didn't know that SR is now producing some of the finest ARF and MicroLaser[tm] Cut kits in the Hobby. Not only that, but we're also publishing a library of modeling information that just isn't available anywhere else.

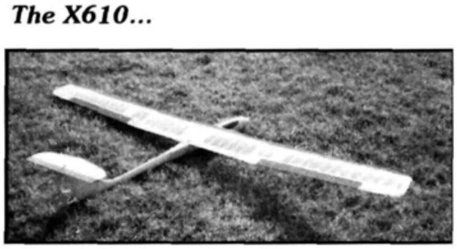
The X440...



If you've seen one of our X440 kits, we really don't have to say much more. The X440 is as good as they come in construction and ease of building and flying. It has a 65" span and 442 square inches of wing area. It weighs 23 ounces for a wing loading of 7.5 ounces per square foot, ready to fly. The aspect ratio is 9.4:1 and it uses Speed 400 power and an optimized S3021 airfoil.

The X440 comes just the way you see it. You'll be ready to head for the field in less than an hour. We also have prop to battery pack power systems available specifically for the X440. Visit our web site for full details.

The X610...

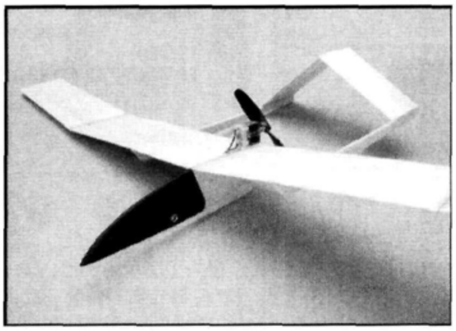


The new SR X610 is an 86" span, almost ready to fly, 49 ounce thermal/duration electric sailplane with a wing area of 610 square inches. The wing loading is only 11.6 ounces per square foot and the aspect ratio is 12:1 for outstanding thermalling ability and wind penetration.The airfoil used is an optimized S3021.

The X610 comes just the way you see it. All you have to do is install your propulsion and radio systems. It can be flown with just aileron and elevator control, but we suggest using rudder too for optimum control.

We have prop to battery pack power systems available specifically for the X610. Visit our web site for full details.

The X70 Micro Electric...



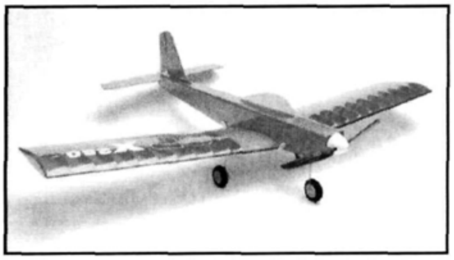
The X70 is a 26" span, 70 square inch hand toss or electric powered Free Flight aircraft that weighs only 1.3 ounces ready to fly!

The X70 is an SR MicroLaser[tm] Cut kit. The balsa is triple selected and it only takes about an hour of building to get the X70 flying.

The X70 kit is only $9.95 plus $3.50 postage and handling and that includes a copy of *Electric Flight Techniques* volume E-26 on Micro Electric Flight.

In addition, we have a power system for the X70 consisting of a Micro 4 motor, two 3.5x3.5 props, charging jack, charging plug, wire, and a two cell SR 50 Series battery pack for only $20 additional if you purchase it at the same time as an X70 kit.

The X250...



The X250 is a 36" span, 250 square inch Speed 400 sport aircraft. It weighs less than 20 ounces ready to fly. Full throttle flights are 7 minutes and partial throttle flights are well over 10 minutes.

The X250 is an SR MicroLaser[tm] Cut kit and you can have an X250 ready to fly in only a week of evenings. An optimized prop to battery pack power system is available separately. Visit our web site for full details.

SR's Techniques Library...

R/C Techniques and *Electric Flight Techniques* are published by SR Batteries. Each volume is only $3 including postage. Here's a partial list of what's available:

R/C Techniques

- Rx/Tx battery pack charging
- The tricks to perfect soldering
- Large aircraft wiring
- R/C aircraft design
- Covering techniques
- Learning to fly R/C

Electric Flight Techniques

- Battery pack charging
- Motor wiring systems
- Motor timing
- Motor break-in
- Speed controls
- Electric props
- Speed 400 systems
- Electric conversions
- Motor mounting techniques
- Multi motor systems

For a full *Techniques* index and complete kit details, please call or write us, or visit our web site,

www.srbatteries.com

-ADVERTISEMENT-

SR Batteries, Inc., Box 287, Bellport, New York 11713

Phone: 516-286-0079, Fax: 516-286-0901, Email: info@srbatteries.com , Web Site: www.srbatteries.com

PRODUCT WATCH

Editors' picks of the month

AT MODEL AIRPLANE NEWS, we not only tell you what's new, but we try it out first to bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."

EASTWOOD CO.

HotCoat Powder Coating System

Cookin' up some color

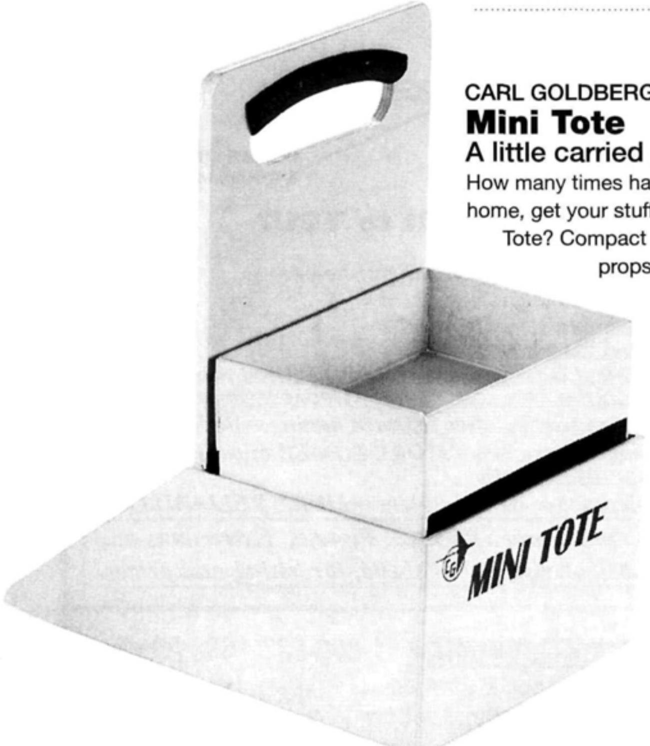
One of my first R/C infatuations was with the O.S. .60 gold head. You can keep the look of your stamped, cast and polished aluminum; this engine was *gold*! That was probably my first conscious exposure to anything having to do with metal coatings. I did eventually buy the engine, and since that time, I've spent a bundle on sending my metal parts out to have them anodized or powder coated.

In theory, the Eastwood* HotCoat process is quite simple: spray an electrostatically charged ultra-fine powdered plastic at a negatively grounded metal object. Remember the last time you played with a pair of magnets? The powder is attracted to the metal as effectively as positive/negative poles of the magnets. From there, the powder is baked to cure the coating.

This inexpensive, powder-coating system is easy to use, and the finish is every bit as good as the quality of the parts I had coated professionally. The basic setup includes a sprayer that fogs on the charged powder at about a pressure of 10psi (you supply the air compressor), the electronic gadgetry that makes the whole process work and an 8-ounce can of gloss-black powder. You need to supply the baking apparatus in which to cure the sprayed parts—one that will *not* be used for food preparation. I picked up a new toaster oven for under $30 and used it with excellent results.

With the HotCoat system, you'll be able to create your own "limited edition" aircraft components in any of 45 colors. The possibilities don't end with hobby-related items, but mufflers, landing gear, tail booms, aluminum spinners and hardware are all obviously good candidates. At $159.95, it will soon pay for itself (part no. 1980).

—Bob Hastings



CARL GOLDBERG MODELS

Mini Tote

A little carried away

How many times have you wanted to go for a quick flight after work, but you didn't have time to run home, get your stuff, then drive back to the field? Why not carry your essentials in the light, tough Mini-Tote? Compact enough to be kept in the car, its removable tray has ample room for fuel, battery, props and field tools. The Mini Tote can be a terrific fueling/starting station, or use it as a separate electrics box for charging paraphernalia and batteries, or even your child's own field box.

It comes in 10 precut pieces, and using Zap Gel, I assembled it in less than an hour (including time spent looking for my clamps). Having assembled and sanded it, finish it off as you'd like. I mixed Z-poxy with Prather microballoons to create small fillets in the fuel-can area, and I followed this by brushing on Pactra* Sanding Sealant. Fuelproof LusterKote yellow spray paint gives it that "just like the picture on the box" look. (One can is enough to cover the whole thing.)

Our Carl Goldberg* Mini Tote has already proven invaluable here at the *Model Airplane News* office. When "Mr. Sun" cooperates, we can leave for photo shoots at short notice, and it's great for our lunch-time heli hops. For $19.99, it's a good value that involves minimum building and gives maximum utility (part no. 101).

—Bob Hastings

F&M ENTERPRISES

Stits Lite Video

Look and learn

Seldom do you run across a "promo" product that does more than just try to sell you a company's product line, so it's nice to get useful information as part of the package; such is the case with F&M Enterprises'* new Stits Lite video.

Chip Mull, owner and operator of F&M, teamed up with video photographer Sam Wright to produce a really good, in-shop presentation. The video starts with a summary of the material's history: the fabric is made by the same company as manufactures full-size polyester aircraft covering. The Scale Stits material is lighter, but it has all of the same properties. Using Stits Lite involves a three-step process, and the materials used (fabric, adhesive and paint) are formulated to work together. Its 10- to 12-percent shrink rate makes removing wrinkles a snap. The line includes Stits Lite polyester fabric, Poly Tac fabric adhesive, Poly Brush primer, Poly Spray silver coat and Poly Tone paint. Use MEK for cleanup, but if you need to thin the paint, a reducer is available from F&M.

Using closeup photography, the video shows how to apply all the materials; and therein lies the bonus information: following Chip's expert guidance, you can cover a model with any fabric.

You'll learn tips for removing wrinkles before you heat-shrink the fabric, how to deal with hard points and protruding hardware, runs and painting blemishes. A bonus is that Chip introduces you to a high-volume, low-pressure painting system that uses 40 percent less paint and produces about 80 percent less overspray than a typical spray gun (and uses only about 5psi air pressure). At $19.95 (plus $3.75 S&H), it's a steal—very interesting indeed.

—Gerry Yarrish

TOWER HOBBIES

Sup-R Sander

True grit!

As a model builder, I have many little quirks that just rule my life in the workshop. Needing to have lots of sandpaper on hand—at all times of the day and night—is one of them. I simply hate to run out of sandpaper in the middle of a project.

Wouldn't it be nice if someone invented a sandpaper that never wore out? Well, the closest thing I've found to this perfect product is the new Products 2000 Sup-R Sander available from Tower Hobbies*.

The Sup-R Sander is not a sandpaper, but it has flat, interchangeable tungsten-carbide sanding surfaces that do the same thing. It's available with a medium, snap-on cartridge or with a pack that includes three sanding cartridges (coarse, medium and fine).

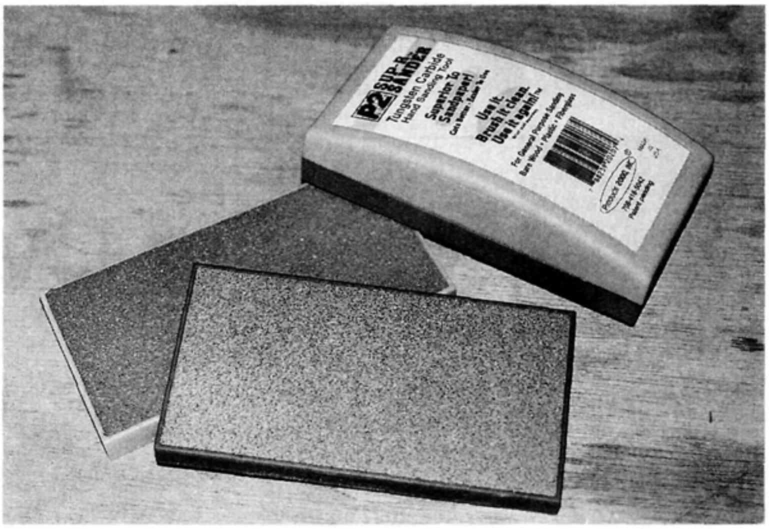
Each of the cartridges simply snaps into place onto the bottom of the hollow yellow plastic handle and is ready to use in seconds. In use, the sander feels exactly like a sanding block, but with one welcome difference: the edges of the sanding surface never lift up to dig into the soft balsa being sanded.

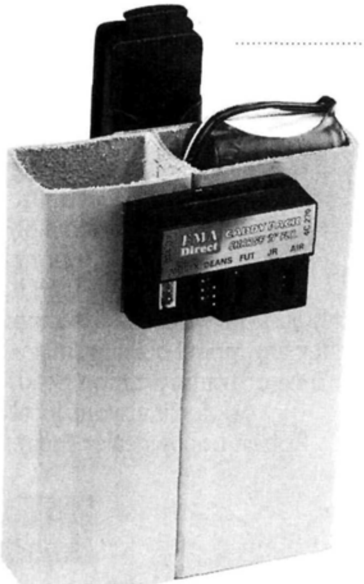
I found that the rough-grit cartridge removes balsa at about the same rate as 80-grit sandpaper while the medium feels like about 180 grit. The fine-grit cartridge does approximately the same job as 220-grit paper. Cleaning is quick and easy (with balsa, at least) with the included brass-wire brush.

The Sup-R Sander may not completely replace sandpaper in the workshop, but it certainly is one of my newest favorite tools. Give it a try; I think you'll like the way it works.

- Part no. TC2038 (with one medium-grit cartridge), $8.99; TC2042 (sander assortment pack), $23.99; assorted sanding cartridges—$6.99 each.

—Gerry Yarrish





FMA DIRECT

Caddy Packs

Staying in the loop

After getting rid of my jacket at the field, I always seem to run out of pockets, and this neat, dual-purpose, twin-pocket, leather pouch—the Caddy Pack—is for just such times. It can be clipped onto your belt and quickly detached while the clip remains in place. Not only can you use it to hold personal field items such as your Ni-starter, glow plugs, small tools, etc., but it's also a portable charger!

The Caddy Pack 110/270 features the addition of a 5-cell 1500mAh battery pack along with FMA's* clever Versatile Adapter, so you can charge your 4-cell 110mAh to 270mAh receiver packs without having to return to your field box or walk all the way back to the car! The adapter is compatible with radio gear that has Airtronics, Deans, FMA, Futaba, Molex or JR connectors.

Park fliers and slow fliers, this great item will help you save weight because you'll be able to use smaller, lighter airborne packs and swap them out between flights. All this comes at the reasonable price of $69.90 (part no. CDPK110/270).

—Bob Hasting

**The addresses of the companies featured here are listed alphabetically in the Index of Manufacturers on page 134.*

Manufacturers! To have your products featured here, send them to **Model Airplane News,** attention: Product Watch, Air Age Inc., 100 East Ridge, Ridgefield, CT 06877-4606 USA.

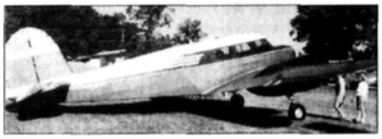
NAME THAT PLANE

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Can you identify this aircraft?

The winner will be chosen four weeks following publication from correct answers received (delivered by U.S. mail) and will receive a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner's subscription will be extended, free, for one year.

Congratulations to Dick Halligan of Waterloo, IA, who easily identified the July '99 issue's mystery plane, the Cessna UC-78 Bobcat, because he received his multi-engine rating in one in 1948. Because of its wood and fabric construction, the plane was also affectionately called the "Bamboo Bomber" by those cadets who trained in it. Powered by two 7-cylinder Jacobs radial engines, this twin-engine lightplane has electric-powered retracts and flaps. The plane has a 41-foot, 11-inch wingspan and is 32 feet, 9 inches long. The UC-78 in the photo is dressed in the civilian Sky King Song Bird colors.



Index of Manufacturers

Ace Hobby Distributors, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037; (660) 584-7121; fax (660) 584-7766.

Aerogloss; distributed by Pactra (address below).

Airtronics, 1185 Stanford Ct., Anaheim, CA 92805; (714) 978-1895; fax (714) 978-1540.

Altech Marketing, P.O. Box 7182, Edison, NJ 08818-7182; (732) 225-6144; fax (732) 225-0091; website: www.modelrec.com.

American Hobby Products, 12 West Hill Cir., Reading, MA 01867; (781) 944-8316; fax (781) 944-3585.

APC Props; distributed by Landing Products (address below).

Area Fifty-One Technologies, 7250 Peak Dr., Ste. 102, Las Vegas, NV 89128; (800) 328-0184; fax (702) 948-1104; website: www.afot.com.

Bob Smith Industries, 8060 Morro Rd., Atascadero, CA 93422; (805) 466-1717; fax (805) 466-3683.

Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651; (773) 626-9550; fax (773) 626-9566.

Castle Creations, 1625 E. Drury Ln., Olathe, KS 66062; (913) 397-0813.

Cermark Electronics, 107 Edward Ave., Fullerton, CA 92833; (714) 680-5888; fax (714) 680-5880.

Cloud-9 R/C, 4326 Andes Dr., Fairfax, VA 22030; phone/fax (703) 273-0607.

Cox Hobbies, P.O. Box 270, Penrose, CO 81240; (719) 372-6565.

David Lewis, 4027 Rocky River 26, Cleveland, OH 44135-1147; (216) 251-2517.

Deans, 7628 Jackson St., Paramount, CA 90723; (562) 634-9401; fax (562) 634-9403.

Du-Bro Products, P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (847) 526-1604; website: www.dubro.com.

Durable Aircraft Models, 59 Matisse Circle, Aliso Viejo, Ca 92656; phone/fax (949) 362-9222; website: www.durableair-craftmodels.com.

Dusty Joe's Precision Aero Kits, 325 Southeast Ave., Tallmadge, OH 44278.

Dynaflite, P.O. Box 1011, San Marcos, CA 92069; (760) 744-9605.

The Eastwood Co., Box 3014, Malvern, PA, 19355-0714; (800) 345-1178; Canada (800) 820-9042; fax (610) 644-0560; website: www.eastwoodco.com.

E-Jets; distributed by Animated Objects Inc., 8929 N. Ferber Ct., Tucson, AZ 85742; (520) 579-5609; fax (520) 579-5610; website: www.ejets.com.

ElectroDynamics, 31185 Schoolcraft, Livonia, MI 48150; (734) 422-5420; fax (734) 422-5338; website: www.electrodynam.com.

EMS, 22483 Mission Hills Ln., Yorba Linda, CA 92687; (714) 692-1393.

F&M Enterprises, 22522 Auburn Dale Dr., El Toro, CA 92630-5005; phone/fax (949) 583-1455; website: www.stits.com.

FMA Direct, 9607 Dr. Perry Rd., Unit 109, Ijamsville, MD 21754; (800) 343-2934; fax (301)831-8987; website: www.fmadirect.com.

Futaba Corp. of America, P.O. Box 19767, Irvine, CA 92723-9767; (949) 455-9888; fax (949) 455-9899.

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

Global Quality Kits; distributed by Global Hobby Distributors (address above).

Gold-N-Rods; distributed by Sullivan Products (address below).

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; website: www.greatplanes.com.

Gus Morfis Plans, 4709 Green Meadows Ave., Torrance, CA 90505-5507; (310) 378-5679.

Hitec RCD Inc., 12115 Paine St., Poway, CA 92064; (858) 748-6948; fax (858) 748-1767; website: www.hitecrcd.com.

Hobbico; distributed by Great Planes Model Distributors (address above).

Hobby Club Inc., 931 Calle Negocio, Ste. F., San Clemente, CA 92673; (949) 498-5377.

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948; website: www.hobby-lobby.com.

Hobby Poxy, 36 Pine St., Rockaway, NJ 07866; (973) 625-3100; fax (973) 625-8303.

Jerry Bates Plans, 102 Glenwood St., Mobile, AL 36606; (334) 478-6720.

Jett Engineering Inc., 6110 "J" Milwee St., Houston, TX 77092; (713) 680-8113; fax (713) 680-8164.

JR, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511; website: www.horizonhobby.com.

Klett; distributed by Carl Goldberg Models (address above).

Landing Products, 122 Harter Ave., Woodland, CA 95776; (916) 661-0399.

Magnum; distributed by Global Hobby Distributors (address above).

Main Planes, P.O. Box 582, College Place, WA 99324; (509) 529-9256.

Megatech; distributed by America's Hobby Center, P.O. Box 32, North Bergen, NJ 07047-0032; website: www.megatechrc.com.

MonoKote; distributed by Great Planes (address above).

Northeast Sailplane Products, 16 Kirby Ln., Williston, VT 05495; (802) 658-9482; website: www.nesail.com.

O.S.; distributed by Great Planes; website: www.osengines.com.

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FINAL APPROACH

BY TONY AVAK

A biplane with biceps

Eleven schools participated in the third annual Design, Build and Fly Competition held this year at the Navy's Webster Field in St. Inigoes, MD, home of the VC-6 Unmanned Air Vehicle (UAV) squadron. The contest was sponsored by the American Institute of Aeronautics and Astronautics (AIAA) and Cessna Aircraft, supported by the Office of Naval Research, and run under the auspices of the AMA. The Naval Air Warfare Center Aircraft Division at Patuxent River, MD, hosted the event.

The competition required each team of students to design and build an R/C, electric-powered aircraft with a wingspan of 9 feet or less that could take off in less than 100 feet, using conventional Ni-Cd cells. While carrying a payload of water ballast, the aircraft had to fly a simple racetrack pattern with a 360-degree turn in the middle of the downwind leg, then land and taxi back to the starting point. Total weight of the aircraft with ballast could not exceed the AMA maximum of 55 pounds. The teams had 10 minutes in which to make as many sorties as possible, and the total amount of water carried in that time was weighed. Awards of $2,500, $1,500 and $1,000 were given to the schools of the first-, second- and third-place winners.

The winner of this year's event was the team from Utah State University and their Dragon Fly aircraft. The design shows a great understanding of the engineering requirements of the contest. Theirs was one of two biplanes that flew in the event; this effectively doubled the wing area and halved the wing loading. The three motors provide a lot of thrust to quickly accelerate the aircraft to flying speed even at maximum payload, and the lower wing provides some ground effect to help lift the plane into the air with minimal ground roll.

The tall, narrow fuselage is highly streamlined. The 8 liters of ballast (carried in bottles inside the fuselage) are easily accessed by a hinged fuselage top, and the carbon-fiber tail boom is slanted up to keep the tail off the ground during takeoff rotation. The tall vertical tail maintains good yaw stability by keeping much of the tail surface out of the turbulent air immediately behind the main fuselage. Flaps reduce landing speed for a more controlled approach. The main landing gear is made of composite materials to minimize weight and absorb impact without bending or breaking.

The Dragon Fly has a 9-foot wingspan and weighs 37 pounds empty. It uses one Aveox 1415/3Y and two 1412/4Y motors (with one Zinger wood 20x10 and two Master Airscrew 22x12 props) with 3.7:1 gear ratios on 30, 28 and 28 (86 total) SR sub-C cells. The wings have an Eppler 1211 airfoil and are made of foam core with 1/32-inch obechi wood sheeting and are reinforced with a carbon-fiber spar.

Utah's win did not come easily. On the first competition flight, the team discovered that the Dragon Fly's wing props were slightly out of balance, causing the right wing motor to vibrate off in flight! As the motor flew off, that prop dug a big piece out of the leading edge of the upper wing. Fortunately, the model was able to land without incident on the two remaining motors, and the team repaired the aircraft by the next morning.

Showing true competitive spirit, Utah State was not content with the first-place lead they enjoyed on the last day

with five sorties and 73.5 pounds of water. They flew once more that day for a remarkable total of 104 pounds of water transported in six sorties. Second place went to Oklahoma State University with 71.5 pounds in three sorties, and third went to the University of Southern California whose entry carried 49 pounds in five sorties.

Special thanks to all the volunteers from the Office of Naval Research, Cessna Aircraft Co., AIAA Foundation, AMA, Webster Field, Patuxent River Naval Air Station and members of the VC-6 UAV squadron.

For more information about this event and other AIAA activities, go to www.aiaa.org and follow the links to the student design competitions, or go directly to amber.aae.uiuc.edu/~aiaadbf for the rules of next year's contest.